



**Peace River
Manasota**

Regional Water Supply Authority

*Southwest Florida
Water Management District*

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Integrated Regional Water Supply Plan 2020 Update

FINAL



July
2020



Acknowledgements

The Peace River Manasota Regional Water Supply Authority (Authority) would like to acknowledge the Southwest Florida Water Management District (District) and staff for their partnership in the development of this Integrated Regional Water Supply Plan 2020 Update. The District's continued support and guidance through the cooperative funding program and technical review process were key to the success of this effort. In addition, we are grateful to our professional colleagues whose works are cited in this text as well as the technical reviews and input received from Authority members and customers.



EXECUTIVE SUMMARY

The Peace River Manasota Regional Water Supply Authority (Authority) is comprised of Charlotte, DeSoto, Manatee, and Sarasota Counties and was created for the purpose of developing, storing, and supplying potable water while prioritizing environmental health. The Authority currently provides potable water to Charlotte County, DeSoto County, Sarasota County, and the City of North Port. Manatee County is projected to begin receiving water from the Authority by 2037. These four counties and the City of North Port are referred to as “Customers.” The Authority also partners with the City of Punta Gorda and the Englewood Water District (EWD), referred to as “Partners,” during emergency or drought conditions through a joint water use permit (WUP).

Florida Statutes require each of Florida’s five water management districts to evaluate their water resources to ensure that water demands can be met over 20-year planning horizons while still protecting natural resources. In collaboration with water resource stakeholders, each District prepares a Regional Water Supply Plan (RWSP) that identifies planned water resource development projects and water supply development projects that can be implemented by water providers. These RWSPs are updated every five years, and the Southwest Florida Water Management District’s (SWFWMD’s) next RWSP update is due in 2020. Florida Statutes also encourage the development of alternative water supply (AWS) sources to supplement traditional sources of water. This Plan is intended to inform SWFWMD’s next RWSP as well as guide further development of water supply sources in the Region.



Authority's Water Treatment Plant has a finished water capacity of 51 MGD.

INTEGRATED REGIONAL WATER SUPPLY PLAN

2020 Objectives

- Inventory the current and permitted water supplies and treatment capacities within the region
- Project the most probable regional potable water demands to 2040 and 2070
- Conceptualize potential water supply development projects within the Authority's four-county region, their feasibility, and their planning-level life-cycle costs
- Assess the regional transmission system piping for future water delivery needs
- Document opportunities for regional water conservation
- Prioritize water supply development projects and transmission system expansion projects based on the need for demand and delivery

WHY PLAN?

There is constant oversight over Florida's available water resources. Florida's five Water Management Districts (WMDs) assess surface water bodies, along with their ecosystem health and impose regulations, such as minimum flows and minimum water levels (MFLs). These regulations serve to protect state waters and include provisions to recover them to more sustainable conditions. The WMDs also assess aquifer system conditions, delineate Water Resource Caution Areas (WRCAs), and develop water use restrictions to protect groundwater supplies. These protections must be addressed in any water supply plan.

By taking a regional perspective, the Authority is able to collaborate with the region to develop the most financially, socially, and environmentally reasonable water supply projects.

CURRENT AND PERMITTED REGIONAL WATER SUPPLIES

The Authority owns and operates the Peace River Facility (PRF), a 51 million gallon per day (MGD) conventional surface water treatment facility located on Kings Highway in DeSoto County. The treatment plant is supported by a 120 MGD intake pump station on the Peace River, a 6.5 billion gallon off-stream raw water storage system, and 21 aquifer storage and recovery (ASR) wells that provide additional large-scale storage. The Authority's PRF WUP also authorizes River withdrawals up to 258 MGD and an additional 26 ASR wells (total of 47 ASR wells) to be constructed.

As shown in **Figure ES.1**, the Authority, its Members, and its Customers have a diverse collection of water supply sources consisting of surface waters, fresh groundwater, and brackish groundwater. The five major surface water sources utilized in the region for public water supplies include the Braden, Manatee, and Peace Rivers and the Myakkahatchee Creek (including Cocoplum Canal) and Shell Creek. The fresh and brackish groundwater sources in the region include the surficial, intermediate, and upper Floridan aquifers. Each of these water supply sources has unique benefits and challenges. **However, if managed together in a conjunctive manner, they have the capacity to serve the region's current and future water supply needs.**

The current finished water capacity between the Authority and its Customers is 103.5 MGD annual average daily (AAD). However, there are plans to take Sarasota County's University Parkway Water Treatment Plant (WTP), with a finished water capacity of 2.0 MGD AAD, offline by 2025. Similarly, Sarasota County's Venice Gardens WTP is projected to reduce its finished water capacity from 2.66 MGD AAD to 1.5 MGD AAD by 2025. This WTP will then be decommissioned in 2030. This culminates in a permitted water capacity of 98.9 MGD AAD between the Authority and its Customers. Sarasota County's Carlton WTP is currently being upgraded, and it is anticipated that the withdrawal quantities from the University Parkway WTP and Venice Gardens WTP will be transferred to the Carlton WTP. No other reductions in finished water capacity are expected through 2040. The 98.9 MGD AAD finished water capacity sets the baseline availability for comparison to projected demands.

Though treatment infrastructure has not been built, the following water use permits are secured: Authority's Peace River Facility Capacity Expansion (potential finished water yield of 15 MGD), Manatee County Buffalo Creek Wellfield (potential finished water yield of

3 MGD), West Villages Brackish Wellfield (yield of 2.0 MGD), and Peace River Facility ASR Wellfield Expansion (yield of 4.5 MGD). The 4.5 MGD is only available with improvements at the plant along with additional storage — the reservoir expansion will also suffice for additional storage needed too.

These secured water use permits, along with additional potential water sources, are considered as alternatives for prioritization with respect to future regional water supply development.

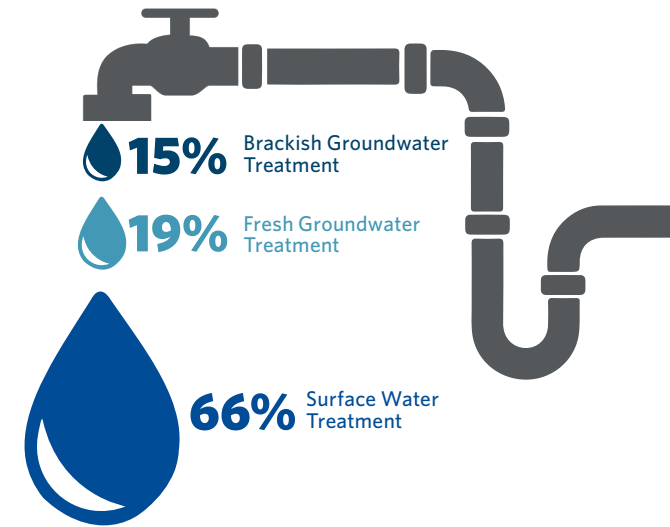
Most Probable Finished Water Needs of Authority's Customers

Seven methodologies were employed to provide a range of regional demand projections for the 2020-2040 planning period. Methodologies included projections provided annually to the Authority by its Customers, actual water usages recorded by the Authority, population growth estimates provided by the Bureau of Economic and Business Research (BEBR), and the SWFWMD RWSP. These projections were then compared to produce what is known as the "Most Probable Range of Demands" for 2040 shown in **Table ES.1**, from which the median was calculated to produce what is known as the "Most Probable Demand" for 2040. The Most Probable Range of AAD Demands for 2040 was found to be between 90.85 MGD to 107.11 MGD, with a Most Probable AAD Demand of 98.67

Table ES.1: Most Probable Range of Demands

PROJECTION	ANNUALIZED GROWTH RATE	MGD					
		2020	2025	2030	2035	2040	2070
High	1.98%	72.36	79.82	88.04	97.1	107.11	192.86
Median	1.60%	71.83	77.76	84.19	91.14	98.67	158.85
Low	1.22%	71.29	75.74	80.48	85.51	90.85	130.72

Figure ES.1: Current Mix of Drinking Water Supplies (103.5 MGD in 2020)



Methodologies to Estimate the Most Probable Demand Projections

- Compiled from Authority's Customers
- Customers Projections Adjusted Down for Average Starting Demands
- High Projections (BEBR)
- Medium Projections (BEBR)
- Population Trend for Last 20 Years
- Authority's Actual Distribution
- SWFWMD's Draft 2020 RWSP Projections

MGD. Between 2040 and 2070, the demands were extrapolated using their corresponding annualized growth rates.

The Authority has developed a Best Management Practice (BMP) that reserves a 6% rotational capacity in the water supply system to remain available above projected water demands for operational flexibility during peak flow periods. On top of this BMP, the Authority requires future water capacity projects to come online before the projected demand reaches 90% of the regional installed capacity and rotational supply reserve. These stacked conditions equate to a finished water requirement of 16.6% above projected demands, which is termed the 17% capacity standard. Utilizing this standard, the Most Probable Finished Water Requirement in 2040 is 115.0 MGD. By 2070, a Finished Water Requirement of 185.2 MGD is projected. **Figure ES.2** compares these finished water requirements with the region's current finished water capacity.

The Authority and its Customers are projected to need additional finished water capacity by 2030. By 2040, an additional finished water capacity of 16.0 MGD is needed. By 2070, an additional finished water capacity of 86.2 MGD is needed.

This IRWSP 2020 also evaluated the historic daily demands for seasonality and peaking factors. The Authority's Master Water Supply Contract (MWSC) has three flow allocations for each Customer: AAD, peak month daily (PMD), and maximum day (MD). The PMD has been set at 1.2 times the AAD, and the MD has been set at 1.4 times the AAD. Based on the data analysis shown in **Figure ES.3**, the current peaking factors appear valid and no changes are recommended to these ratios into the future.

Figure ES.2: Most Probable Finished Water Requirements

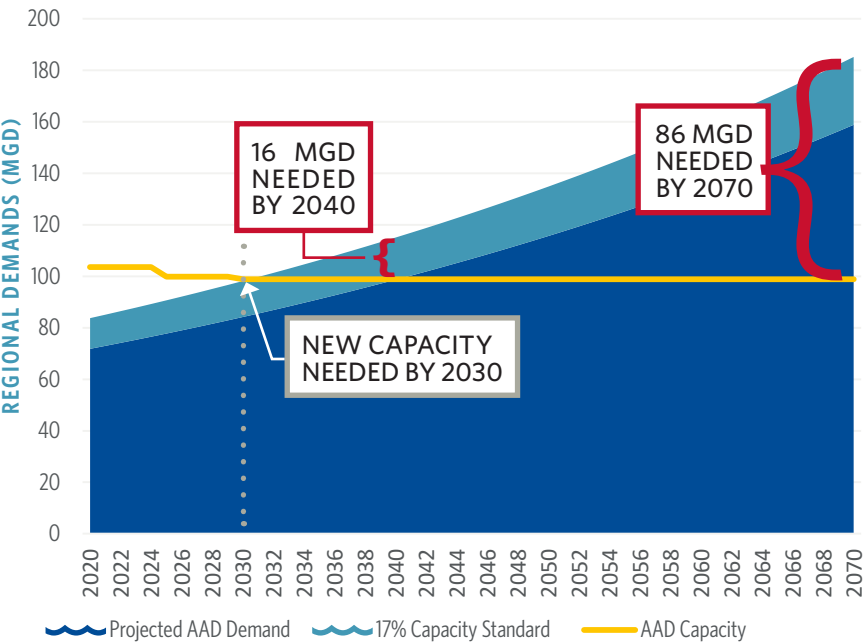
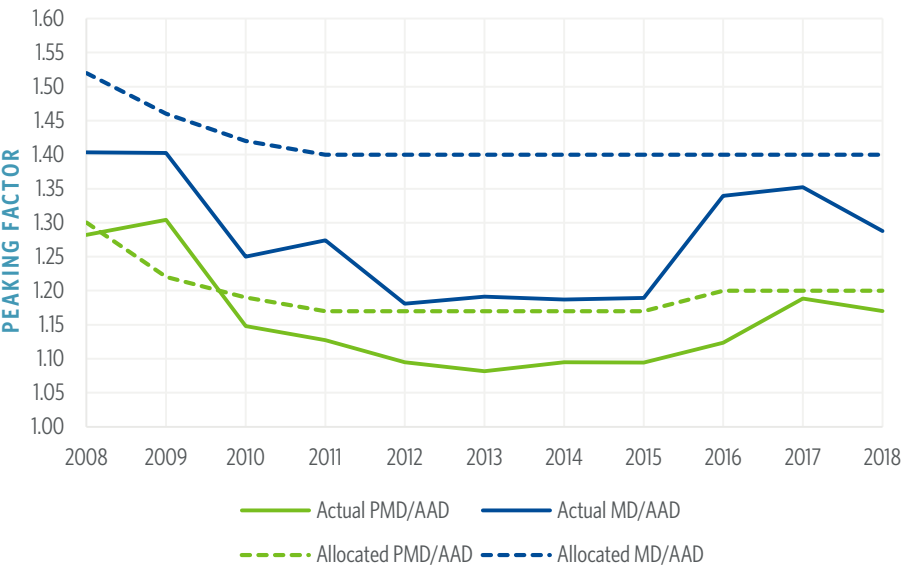


Figure ES.3: Master Water Supply Contract Peak Flow Allocation Analysis



Potential Regional Water Supply Development Projects

Previous planning efforts over decades have kept watch on a vast array of potential water supply development opportunities; however, the feasibility of constructing the identified opportunities evolve over time due to water use permitting by other entities, updates to MFLs, WRCA recovery plans, or use of the targeted water source for a non-potable purpose. In total, 13 water sources within the region have been identified for the possibility of future development for drinking water. These water sources consist of fresh/brackish surface water, fresh/brackish groundwater, seawater, and high salinity groundwater. Potential development opportunities of these 13 sources have resulted in 18 potential projects shown in **Table ES.2** and **Figure ES.4**. Several of these projects are already being planned by the Authority and Customers. Some of these projects have been carried forward from previous IRWSPs, and some of these projects are new in concept. The projects have been ordered in ascending total cost per finished water capacity yield.

The total potential new finished water capacity that could be developed within the region in conjunction with these projects is 137.5 MGD AAD. This capacity is sufficient to meet the regions needs through 2070, however, the feasibility of constructing these projects will evolve

Figure ES.4 – Potential Source Water Development Opportunities

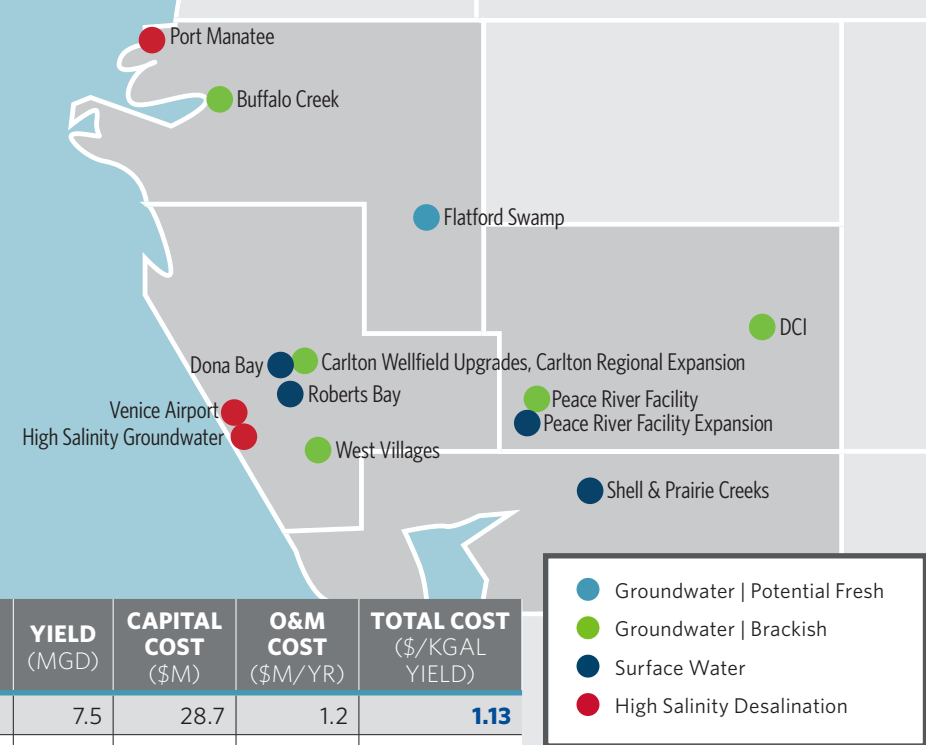


Table ES.2: Potential Finished Water Supply Development Projects

PROJECT	STATUS	WUP SECURED	YIELD (MGD)	CAPITAL COST (\$M)	O&M COST (\$M/YR)	TOTAL COST (\$/KGAL YIELD)
Planned Carlton Wellfield Upgrades	Partly Complete	No	7.5	28.7	1.2	1.13
Peace River Facility Phase II Capacity Increase and ASR Wellfield Expansion	In Authority's CIP	Yes	4.5	32.3	1.3	2.09
Peace River Facility Brackish Wellfield	In Authority's CNA	No	5.5	58.3	4.2	3.96
Manatee County Buffalo Creek Brackish Wellfield	In Manatee County's Work Plan	Yes	3	38.3	2.7	4.72
Carlton Wellfield Expansion Concept	New Concept	No	4	53.4	3.5	4.74
West Villages Brackish Wellfield	In Design	Yes	2	26.0	1.8	4.81
Peace River Facility Surface Water System Expansion	In Authority's CIP	Yes	15	332.2	5.4	4.94
Cow Pen Slough Surface Water Facility Phase 1	Partly Complete	No	5	82.8	3.7	5.00
DeSoto Brackish Wellfield Near DCI	No action	No	5	78.5	4.1	5.04
Flatford Swamp Groundwater Recovery Concept	New Concept	No	5	113.4	1.8	5.04
Seawater Desalination Facility Near Port Manatee	No action	No	20	271.8	23.1	5.58
Seawater Desalination Facility Near Venice Airport	No action	No	20	287.4	23.1	5.73
High Salinity Groundwater Desalination	New Concept	No	10	173.2	12.1	6.41
Shell and Prairie Creeks Surface Water Facility	No action	No	20	442.4	24.9	7.35
Blackburn Canal Surface Water System	No action	No	5	179.7	6.0	9.70
Cow Pen Slough Surface Water Facility Expansion	New Concept	No	10	--	--	--
Partially Treated Water Aquifer Recharge	New Concept	No	0	3.5	0.1	N/A
Peace River Facility Raw Water ASR	Permit App Submitted	Pending	0	8.3	0.9	N/A

over time. As the region continues to grow, the outlook for potential projects must consider the regulatory climate, including MFLs and SWUCA rules for groundwater development. As shown in **Figure ES.5**, the potential source types are diverse; however, the region will eventually need to look for additional alternative water supplies including high salinity desalination.

In addition to the 137.5 MGD potential finished water development project list, the Authority may consider continuing to investigate reclaimed water as a potential water source. Within the Authority's

four-county region, an estimated 22 MGD of reclaimed water is utilized for aquifer recharge or discharged to saline waters. The Authority could utilize current and evolving indirect potable reuse (IPR) regulations. The full-scale implementation of reclaimed water as a water supply is becoming more accepted over time. For the Authority, IPR concepts would require careful planning and consideration to make the concept economically feasible.

REGIONAL TRANSMISSION SYSTEM RECOMMENDATIONS

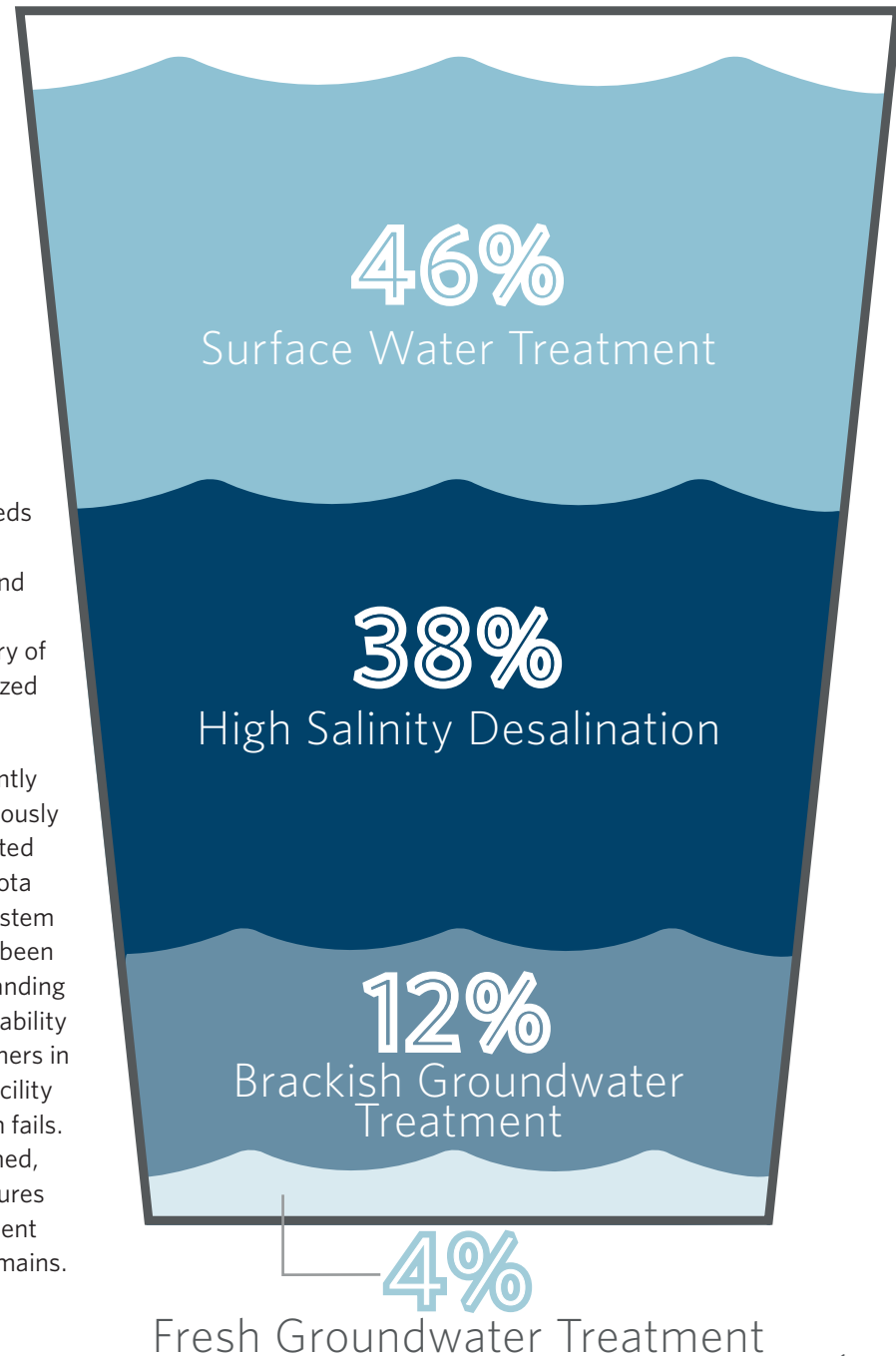
The Authority's integrated regional loop system includes approximately 70 miles of large-diameter drinking water transmission system pipelines and associated remote pumping stations and finished water storage tanks. This regional transmission system is designed to deliver allocated water supply to its Customers from the Peace River Facility. This strategy to interconnect major water treatment plants in the region provides for resiliency with respect to regional water sharing, conveyance to support emergency needs, and overall cost savings to the regional consumers.

In 2006, the Authority completed a Regional Integrated Loop System Feasibility/Routing Study (PBS&J, January 2007) which identified a transmission network that would interconnect individual water systems with regional supplies in the Authority's service area. Since then, the Authority has completed construction of 25 miles of regional pipeline, with 11 more miles in construction now. Planning continues for the remaining transmission pipelines required to complete the Authority's regional vision. Annually,

the Authority updates their Capital Improvements Plan (CIP) and Capital Needs Assessment (CNA). The CIP includes projects to be initiated within five years and the CNA includes projects to be initiated within 20 years. The most recent inventory of regional transmission mains are summarized in **Table ES.3** (following page).

The Phase I and Phase IIIB TMs are currently under construction. The Authority's previously planned Phase IIID pipeline was constructed by a private entity and conveyed to Sarasota County as part of the local distribution system in 2017. Since the 2015 Plan, efforts have been undertaken to provide improved understanding of the regional water supply system's capability to deliver water to the Authority's Customers in the event that a major water treatment facility goes offline or regional transmission main fails. An initial desktop evaluation was performed, and protocols were developed for procedures to individually bypass seven water treatment facilities and eight regional transmission mains.

Figure ES.5: Mix of Potential Source Capacities (Up to 137.5 MGD Yield)



To advance the understanding of the interconnected system, a Master Model was developed in Bentley WaterGEMs. This Master Model was developed by reviewing nine individual hydraulic models developed across five different software platforms, and merging the most updated infrastructure together. The model was validated for regional system flows and pressures. This model was then implemented to run various scenarios under normal annual average daily demand (AADD) and maximum daily demand (MDD) conditions for 2020, 2040, and 2070. These scenarios assess regional transmission system capacity needs including validation of planned pipe segments and alternate pipe segment conceptualization. Finally, selected emergency scenarios were run through the model to simulate 2020 AADD and 2040 AADD conditions with major treatment facility and transmission mains offline. These emergency scenarios are listed in **Figure ES.7**.

Each of the municipalities within the Authority's four-county region have a different level of dependence on the Authority's finished water. These simulations have shown that though some municipalities are self-sufficient under normal conditions, a regional interconnected system is critical during emergency situations. Regional transmission of drinking water allows for the four-county region to grow organically, while efficiently supplementing water pressure in concentrated growth areas. Furthermore, the regional interconnect system allows for optimization of treatment capacities within the region's individual distribution systems. **Figure ES.6** shows the current regional water treatment plants, current regional transmission system, proposed pipelines, and proposed delivery points.

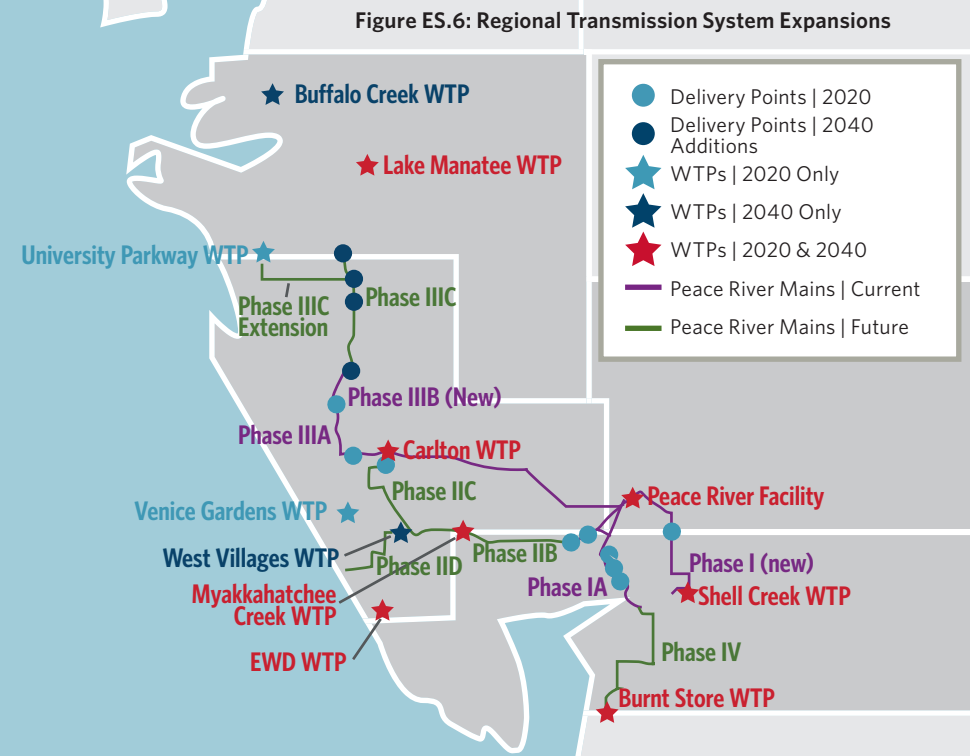


Figure ES.7: Emergency Scenario Simulations

Table ES.3: Planned Regional Transmission Mains

PIPELINE	LENGTH (MILES)	NOMINAL DIAMETER (INCHES)	ROUTE	STATUS
Phase I	7	24"	US17 @ Enterprise to Punta Gorda Shell Creek WTP	In Construction — Complete in 2020
Phase IIB	10	36"/42"	Charlotte County line near Serris Boulevard to North Port Myakkahatchee Creek WTP	In 2020 CIP — Complete in 2026
Phase IIC	14	36"	North Port Myakkahatchee Creek WTP to Sarasota County Carlton WTP	In 2020 CNA — Complete in 2036
Phase IID	12.5	24"	North Port Myakkahatchee Creek WTP to EWD's System at Keyway Road and S.R. 776	In 2020 CNA — Complete in 2039
Phase IIIB	5	48"	Preymore/SR681 Interconnect to Clark Road	In Construction — Complete in 2021
Phase IIIC	10	36"/24"	Clark Road to University Avenue	In 2020 CNA — Complete in 2029
Phase IV	15	24"	Burnt Store WTP to Phase IA Pipeline near Ridge Road and Highway 17	In 2020 CNA — Complete in 2040



Emergency Scenario Simulations

- Peace River Facility Offline
- Carlton WTP and Phase IIIA Offline
- Lake Manatee WTP Offline
- 24" Phase IA Offline
- 42" Phase II Offline
- 48" Phase IIIA Offline
- 20" DRTM Offline
- 42" NRTM Offline

RECOMMENDATIONS

PHASE IIB

Continue based on the spatial balance of growth in North Port, findings of the Charlotte County Master Plan, and future conveyance needs for EWD.

PHASE IIC

Recommend proceeding with a Feasibility and Routing Study in tandem with Phase IIB.

PHASE IID

Reassess the need if WTP capacities surrounding Sarasota County do not proceed as planned and future delivery needs for EWD.

PHASE IIIC

Recommend proceeding with a Feasibility and Routing Study.

PHASE IIIC EXTENSION

Recommend proceeding with a Feasibility and Routing Study in tandem with Phase IIIC

PHASE IV

Proceed as planned provided that either the Burnt Store WTP can be expanded by 2040 for additional capacity for distribution to the region or if Charlotte County requests the need for the Authority to supplement the Burnt Store service area demands.

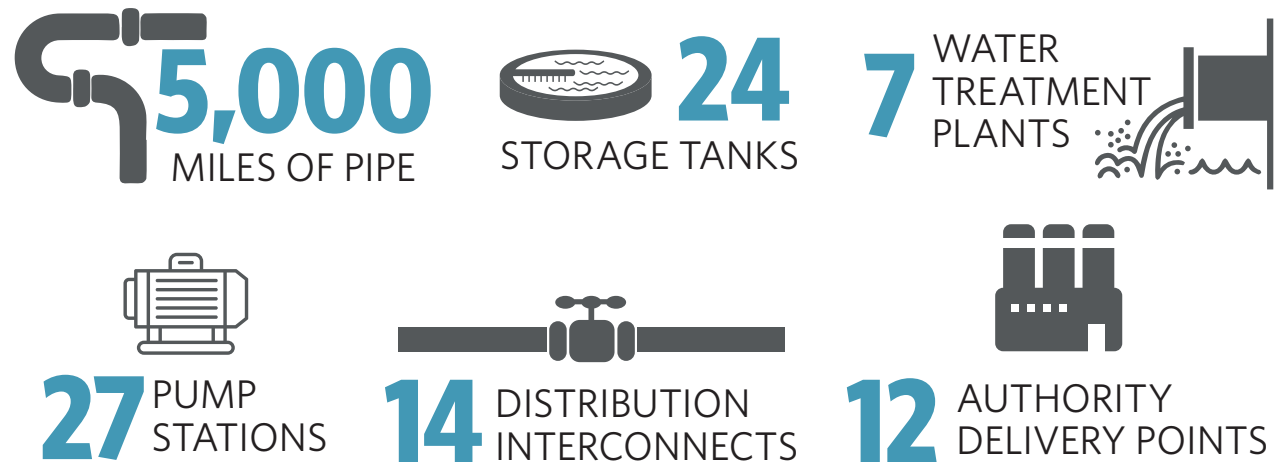
Similar to water source development, regional transmission needs can evolve over time as communities are developed, population grows in concentrated or wide-spread areas within municipal jurisdictions, and local water source developments are expanded or restricted. As the Authority continues to plan, it is recommended that the Master Model continue to be utilized and updated to help plan for the growing areas of water needs.

Table ES.4 lists the recommended regional transmission system expansion pipe segments, length, diameter, planning-level costs and recommended completion dates.

Table ES.4: Regional Transmission System Expansion Planning

PIPELINE	LENGTH (MILES)	NOMINAL DIAMETER (INCHES)	PIPELINE & EASEMENT COST (\$M)	STORAGE & BOOSTER STATION FACILITIES COST (\$M)	TOTAL COST (\$M)	RECOMMENDED COMPLETION DATE
Phase IIB	10	36"/42"	43.8	14.1	57.9	2026
Phase IIC	14	36"	51.5	9.9	61.3	2036
Phase IID	12.5	24"	25.4	7.0	32.4	2040
Phase IIIC	10	48"/24"	35.3	22.3	57.6	2028
Phase IIIC Extension	10.8	30"	27.7	1.0	28.7	2028
Phase IV	15	24"	29.1	7.0	36.1	2040

Figure ES.8: Master Model Elements



WATER CONSERVATION/DEMAND MANAGEMENT

Water conservation is a key component of an effective water supply planning process. Indeed, conservation is often one of the most cost effective, environmentally compatible, and readily available alternatives to help manage the water supply needs of a growing population. The Authority Customers (Charlotte, DeSoto, Manatee and Sarasota Counties and the City of North Port) have long excelled at conservation efforts, including supply and demand management and water use efficiency enhancement.

The Authority's Customers serve a population of over 750,000 citizens. The per-capita water use rates have been well below SWFWMD's goal of less than 150 gallons per capita per day (gpcd). Between 2003 and 2009, the gross water use for this growing customer base reduced from 105 gpcd to 85 gpcd as shown in **Figure ES.9**. Since 2009, the gross water use has been relatively stable. This gross water use considers single-family residential, multi-family residential, and industrial-commercial-industrial users. Residential per-capita water use has been fairly stable since 2008, ranging between 54 and 60 gpcd.

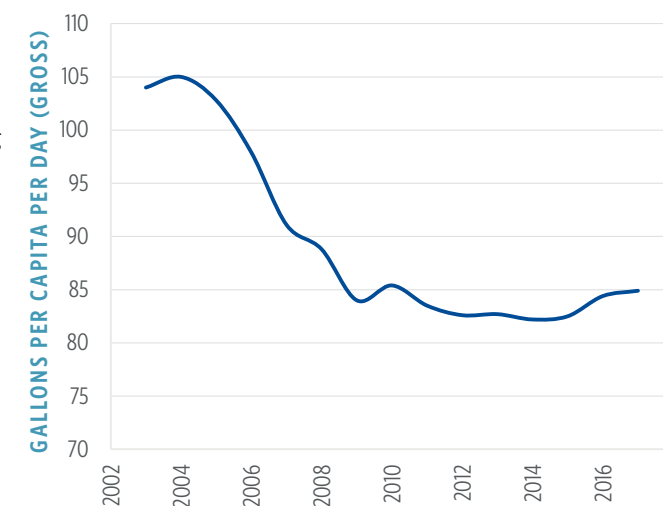
Authority Customers have tiered rates for potable water. Charlotte, Manatee and Sarasota Counties have offered programs for indoor demand management (i.e. rebates to incentivize toilet, showerhead, and faucet retrofits). Relative to outdoor water use, Charlotte, Manatee and Sarasota Counties as well as the City of North Port all have landscape/irrigation ordinances that primarily apply to new construction. Manatee County has a comprehensive rebate program to incentivize existing customers to reduce the use of potable water for irrigation. The City of North Port's landscape/irrigation ordinance allows for reductions in the ERC calculation for LEED Certified, Silver, Gold, or Platinum, Florida Water Star certification, or properties containing a gray water system. All Authority Customers also have water conservation education programs.

Other quantifiable water conservation strategies that could be considered by the Authority Customers might include:

- Require Residential Single-Family WaterSense Toilet Retrofit on Resale
- Require Residential Multi-Family WaterSense Toilet Retrofit on Resale

- Offer High-Efficiency Clothes Washer Retrofit Rebates
- Require Residential Multi-Family Sub-metering
- Offer ICI Sector Water Audits
- Offer ICI Sector WaterSense Toilet/Urinal Retrofit Rebates
- Offer ICI Sector High-efficiency Washer Rebates

Figure ES.9: Average Gross Per-Capita Water Use for Authority Customers



CAPITAL IMPROVEMENT

PLANNING CONSIDERATIONS

The following are recommended actions for the Authority to include within their overall 5-year CIP and 20-year CNA. Note that this documentation does not encompass existing infrastructure maintenance and rehabilitation projects.

Within the Authority's 5-year CIP:

- Proceed with the Peace River Facility Surface Water System Expansion project and the reservoir pump station portion of the Raw Water ASR project to have them online by 2030.
- Should the Authority's PTW ASR permit application be accepted, plan for proceeding with the ASR Wellfield Expansion portion of the Phase II Capacity Increase and ASR Wellfield Expansion project, the Raw Water ASR project, and the Partially Treated Water Aquifer Recharge project.
- Proceed with Feasibility and Routing Study of Phase IIIC and Phase IIIC Extension to have them online by 2028.
- Proceed with Feasibility and Routing Study of Phase IIB and IIC by 2021 to have at least Phase IIB online by 2026.

Additionally within the Authority's 20-year CNA:

- Proceed with the Phase II Capacity Increase and ASR Wellfield Expansion, Peace River Facility Brackish Wellfield project, and/or Carlton Regional Expansion Project continue observing regional demand growth to plan bringing the facility online after 2040.
- Plan for construction Phase IIC to be complete by 2036.
- Plan to reevaluate Phase IV beginning in 2034.
- Plan to reevaluate Phase IID beginning in 2035

Figure ES.10 illustrates a preliminary schedule for the above-mentioned projects for the Authority to consider.

OPPORTUNITIES TO SHARE LOCALIZED EXCESS WATER CAPACITY

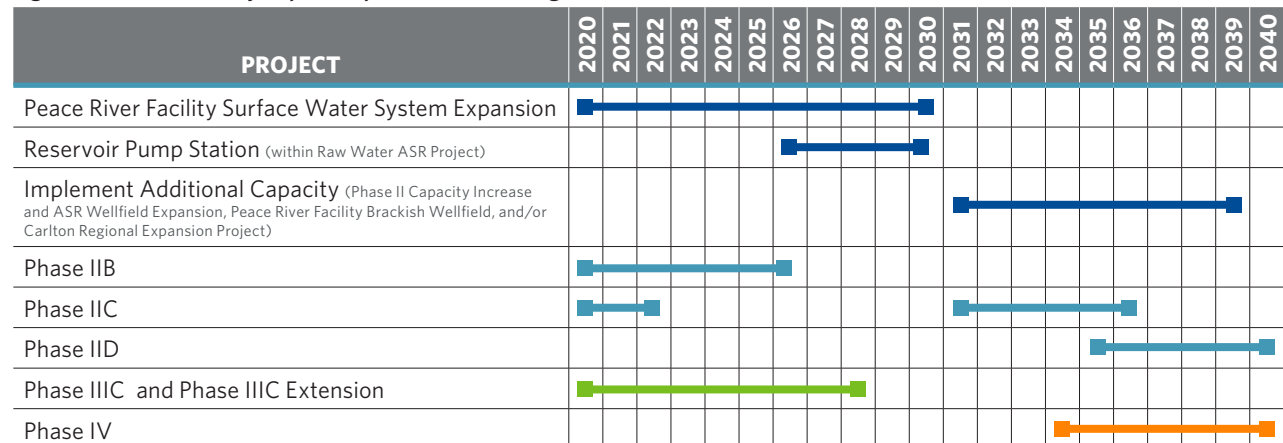
To further regional resiliency and prolong the expedience of capital investments described above, the region could utilize the existing and growing regional transmission system under normal and emergency conditions to share excess finished water capacities of Authority Members, Customers, and Partners. The region currently has an Operational Flexibility Water Use Permit (OFWUP), which allows for operational flexibility by the Authority on a short-term basis if the Peace River Facility goes offline in part or in whole. This OFWUP can benefit the region temporarily; however, it does not account for potential failures of infrastructure that are not operated by the Authority. There is potential to provide longer term water sharing opportunities between utilities within the region for overall responsible regional growth management.

As a region, there is currently an excess finished water capacity of 11.9 MGD AAD; however, this excess capacity is projected to be absorbed by demand by 2030. Regional expansion of the Authority's treatment infrastructure will reverse this capacity deficit; however, within individual Customer and Partner boundaries,

there are projected excess capacities that could be shared long term with neighboring utilities through local interconnects or regional transmission. Of note, Manatee County is projected to have an excess capacity of at least 4.5 MGD through 2040. Punta Gorda is projected to have an excess capacity of at least 3.0 MGD through 2040. EWD is projected to have an excess capacity of at least 1.0 MGD through 2040. The Authority and its Customers, Members, and Partners could benefit from near term and long term excess capacity sharing. In general, it is recommended that the Authority do the following:

- Pursue broadening of the current OFWUP beyond its current temporary withdrawal quantities and restriction on activation only when the Peace River Facility is offline to allow Members, Customers, and Partners flexibility in excess WUP capacities within the region.
- Utilize the Master Model developed as part of this IRWSP 2020 to proactively run scenarios of excess capacity sharing so as to more proactively spread water between areas with capacity deficiencies and provide proper distribution system pressures.

Figure ES.10: Preliminary Capital Improvement Planning Schedule





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Appendixes

- A Demand Projections Technical Memorandum
- B Net Benefit Opportunities for Water Supply Development
- C SOP for Regional Water Supply System Emergency Operation
- D Authority Master Model Technical Memorandum



Abbreviations

AAD	annual average daily
AADD	annual average daily demand
AR	aquifer recharge
ASR	aquifer storage and recovery
Authority	Peace River Manasota Regional Water Supply Authority
AWS	alternative water supply
BEBR	Bureau of Economic and Business Research
BMP	Best Management Practice
CIP	Capital Improvements Plan
CNA	Capital Needs Assessment
District	Water Management District
DRTM	DeSoto Regional Transmission Main
EDR	Electrodialysis Reversal
EWD	Englewood Water District
FDEP	Florida Department of Environmental Protection
F.S.	Florida Statutes
FY	Fiscal Year
gpcpd	gallons per capita per day
IAS	Intermediate Aquifer System
IRWSP	Integrated Regional Water Supply Plan
MD	maximum daily
MDD	maximum daily demand
MFL	minimum flows and levels
MIA	Most Impacted Area
MGD	million gallons per day
NOAA	National Oceanic and Atmospheric Administration
MWSC	Master Water Supply Contract
NRTM	North Regional Transmission Main
OFWUP	Operational Flexibility Water Use Permit
PMD	peak month daily
PRF	Peace River Facility
PRMRWSA	Peace River Manasota Regional Water Supply Authority
PSAR	Public Supply Annual Report
RO	Reverse Osmosis
RTM	Regional Transmission Main
RWSP	Regional Water Supply Plan
SOP	Standard Operating Procedure



SWFWMD	South West Florida Water Management District
SWIMAL	Saltwater Intrusion Minimum Aquifer Level
SWUCA	Southern Water Use Caution Area
TM	Transmission Main
UFA	Upper Floridian Aquifer
WRCA	Water Resource Caution Area
WTP	Water Treatment Plant
WUP	Water Use Permit

1 Introduction and Background

1.1 Introduction

In accordance with section 373.709, Florida Statutes (F.S.), each of Florida's five water management districts (Districts) are required to evaluate their water resources to ensure that the reasonable-beneficial needs for water can be met over 20-year planning horizons while still protecting the natural resources within each of the regions. In collaboration with water resource stakeholders, each District prepares a Regional Water Supply Plan (RWSP) that identifies water resource development projects they will implement to protect the natural resources, as well as water supply development projects that can be implemented by water providers. These RWSPs are updated every five years, and the Southwest Florida Water Management District's (SWFWMD's) next RWSP update is due in 2020. In addition, subsection 163.3177(6)(c), F.S. states that local governments, public and private utilities, regional water supply authorities, special districts, and water management districts are encouraged to cooperatively plan for the development of multijurisdictional water supply facilities sufficient to meet projected demands for established planning periods, including the development of alternative water supply (AWS) sources to supplement traditional sources of ground and surface water.

In anticipation of providing regional planning information to the District for inclusion into their 2020 RWSP update, this document is the Peace River Manasota Regional Water Supply Authority's (Authority) Integrated Regional Water Supply Plan (IRWSP) for 2020 (2020 Plan). This 2020 Plan is co-funded by the District and will serve as an update to the Authority's Integrated Regional Water Supply Master Plan completed in April 2015 (2015 Plan) (Atkins et. al., 2015). Since the completion of the 2015 Plan, elements of production capacity, demand, and the regional transmission system have changed. The goal of this 2020 Plan is to deliver a plan update to guide further development of regional water supply capabilities through 2040 to support the Authority in meeting its commitments to members and customers for providing a cost effective, reliable, sustainable, and environmentally responsible regional public water supply while maximizing and optimizing existing facilities and sources.

1.2 Background

The Authority operates as an independent special district of the state of Florida, created and existing pursuant to Sections 373 and 163, F.S. The Authority is comprised of Charlotte, DeSoto, Manatee, and Sarasota Counties and was created for the purpose of developing, storing, and supplying potable water for county and municipal purposes in such a manner as will give priority to reducing



adverse environmental effects of excessive or improper withdrawals from concentrated areas. The Authority is required to acquire, design, secure permits, construct, operate, and maintain facilities in locations and, at the times necessary, to ensure an adequate potable water supply will be available to all citizens within the Authority's boundaries, identified herein as the region.

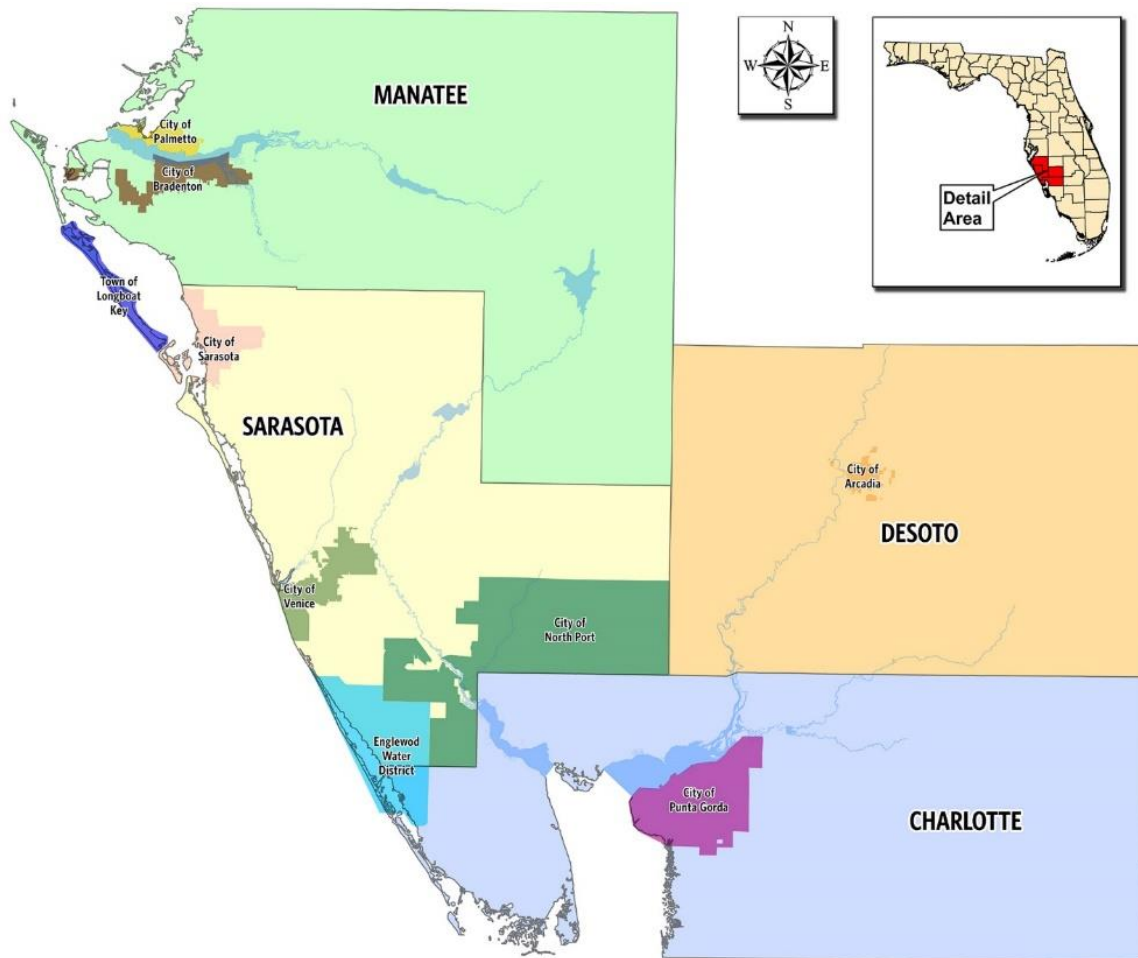
In October 2005, the Authority's member governments and the City of North Port adopted a Master Water Supply Contract (MWSC) that established the terms and conditions for providing potable water from the Authority. The Second Amendment to the MWSC was executed on August, 5, 2015. An important MWSC provision requires that the Authority customers annually provide the Authority with their potable water demand projections for the next 20-year period, identify the basis for those demand projections, and specify how much of that demand they require Authority facilities to meet. These projections are used by the Authority for planning purposes.

The Authority currently provides potable water to Charlotte, DeSoto, and Sarasota Counties, and the City of North Port. In accordance with Manatee County's January 2018 demand projections submitted under the MWSC, the Authority is projected to provide water to Manatee County in about 2037. However, the District currently has set a target of adopting a minimum flows and levels (MFL) for the lower segment of the Manatee River by 2021, and indications are that it may require the release of additional water downstream of Lake Manatee. This may affect the safe yield of this source and possibly result in an acceleration of supply needed for Manatee County from the Authority. Throughout this document the Authority's four member governments and the City of North Port will be collectively referred to as the Authority's "Customers". However, the Authority also partners with the City of Punta Gorda and the Englewood Water District (EWD) during emergency or drought conditions through a joint water use permit (WUP) referred to as the Operational Flexibility WUP or OFWUP (District WUP No. 20012926.002). To this extent, these two entities are collectively referred to as the Authority's "Partners". All other public water supply entities within the region are identified individually within this report.

Figure 1.1 identifies the Authority's four-county region and its Customers, Partners and other public water supply entities in the region.

In 2006, the Authority completed its first Integrated Regional Water Supply Master Plan (2006 Plan) which addressed potable water demands, supplies, and regional connectivity efforts within its service area. Since that time, the Authority completed their 2015 Plan. Through the development of this 2020 Plan, demand projections, future supplies, and opportunities for future regional connections will be updated over the next 20-year planning period. These regular updates help to ensure that potable water needs are met and future water supplies are developed in an orderly, reliable, cost effective, and environmentally sustainable manner.

Figure 1.1 - Peace River Manasota Regional Water Supply Authority Overview Map



As a regional wholesale water supplier, the Authority owns and operates the Peace River Facility (PRF), a 51 million gallon per day (MGD) conventional surface water treatment facility located on Kings Highway in DeSoto County. The treatment plant is supported by a 120 MGD intake pump station on the Peace River, a 6.5 billion gallon off-stream reservoir raw water storage system, and 21 aquifer storage and recovery (ASR) wells that provide additional large-scale storage. As of December 2018, approximately 7 billion gallons have been stored in the ASR system. The Authority's integrated regional loop system also includes approximately 70 miles of large-diameter drinking water transmission system pipelines and associated remote pumping stations and finished water storage tanks. The Authority's PRF WUP also authorizes up to an additional 26 ASR wells (total of 47 ASR wells) to be constructed.

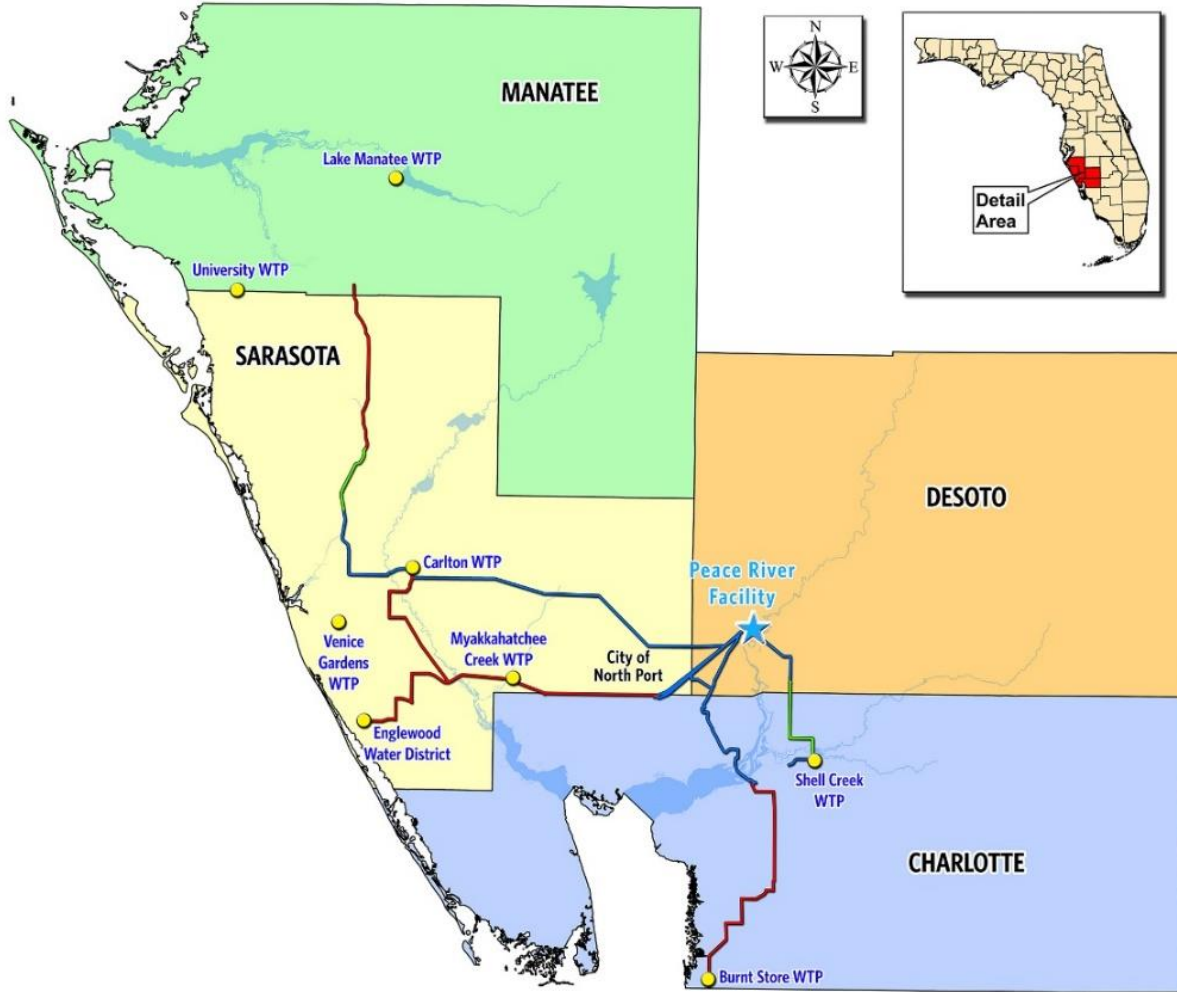
2 Regional Facilities Update

The Authority's four-county service has a diverse collection of water supply sources consisting of surface waters, fresh groundwater, and brackish groundwater. Currently, the five major surface water sources utilized in the region for public water supplies include the Braden, Manatee and Peace Rivers and the Myakkahatchee Creek (and Cocoplum Canal) and Shell Creek. The fresh and brackish groundwater sources in the region include the surficial, intermediate and upper Floridan aquifers. Each of these water supply sources has unique benefits and challenges. However, if managed together in a conjunctive manner, they have the capacity to serve the region's water supply needs now and into the future.

This section contains descriptions of existing potable water supplies and their associated treatment, storage, and distribution facilities owned by the Authority and its Customers. Because the Authority also has access to supplies reserved for regional use at Sarasota County's Carlton Water Treatment Plant (WTP), at Punta Gorda's Shell Creek WTP, and excess supply from the EWD through their OFWUP, descriptions of the existing water supply facilities for Authority Customers and Partners are also included. It is noted that planned facilities that have already received a WUP, but are not yet constructed or in operation, will also be identified as existing and estimated supply capacities, and implementation timing will be noted as found in planning documents.

Figure 2.1 identifies the Authority, Customers, and Partners and associated current permitted and operating water supply facilities.

Figure 2.1 - Facilities of Authority, Members, Customers, and Partners



Reference tables are provided below for each of the four counties (Charlotte; DeSoto; Manatee and Sarasota) as well as the City of North Port, the City of Punta Gorda, and EWD that summarize existing permitted annual average daily (AAD) and peak month daily (PMD) quantities, and associated available finished water capacity. For all references herein, PMD represents the average daily flow during the peak month of water use. Other major public water supply sources in the region are also provided in this section and include the cities of Bradenton, Sarasota, Venice, and Arcadia.

2.1 Existing Sources of Supply

2.1.1 Peace River Manasota Regional Water Supply Authority

The Authority's water supply source is the Peace River in DeSoto County. Water withdrawals from the Peace River are regulated under WUP No. 20010240.010, while withdrawals from supplemental

sources for regional supply associated with the OFWUP are regulated under WUP No. 20012926.002.

Currently, the WUP (issued February 22, 2019) authorizes the Authority to supply the region with an AAD quantity of 80 MGD. This value represents a finished water supply quantity that the Authority is authorized to deliver to its Customers from the PRF, and is not a restriction on river withdrawals, as withdrawals are regulated by a separate diversion schedule within the WUP. The 80 MGD AAD reflects a projected 29 MGD increase in treatment capacity for the PRF in the future. Under that future capacity scenario – the 80 MGD quantity would be an expected wet-year maximum delivery from the facility. WUP 2010420.010 has been issued for a permit term of 50 years to reflect the importance of this facility to the region and the care and environmental stewardship that has been exercised in its operation by the Authority.

The OFWUP was issued September 10, 2013 and expires September 10, 2033. The OFWUP authorizes the AAD and PMD use of 7.251 MGD and 11.600 MGD, respectively, on a short-term basis by the Authority for operational flexibility when the primary surface water source at the PRF is temporarily unavailable in part or whole. The OFWUP quantities are in excess of the individual WUPs quantities allocated to Sarasota County (WUP 20008836.013) and the City of Punta Gorda (WUP 20000871.011); however, they are not for EWD (WUP 20004866.010) as explained below. The OFWUP sources include those listed below:

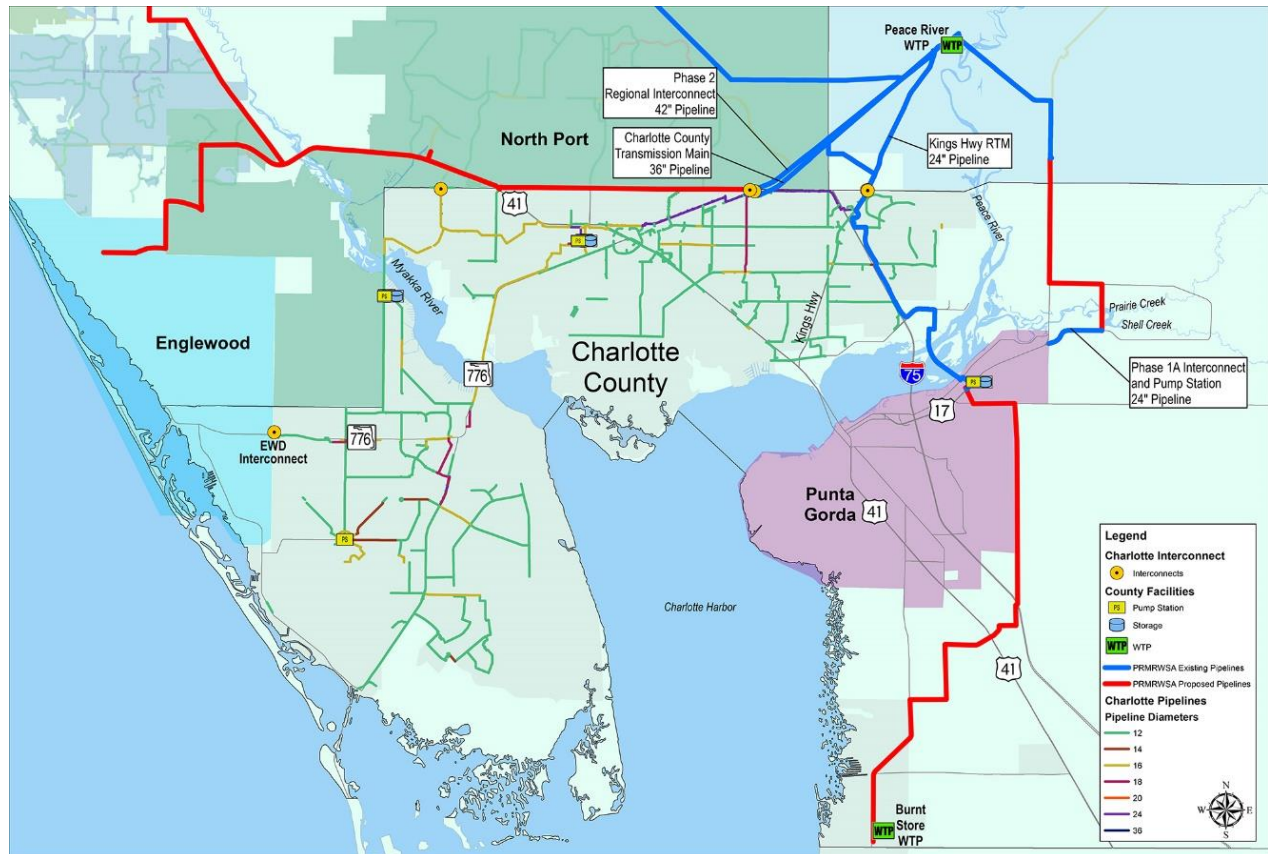
- 5.0 MGD of AAD and PMD from Sarasota County's Carlton Memorial Reserve Wellfield;
- 2.2 MGD and 6.0 MGD AAD and PMD, respectively, from Punta Gorda's Shell Creek Reservoir;
- 2.0 MGD of AAD and PMD, respectively, from the EWD Wellfields (these quantities are included in EWD's WUP, and are considered allowable emergency supply if EWD's own demand is exceeded; therefore these quantities are not included in the OFWUP allocated quantities); and
- AAD and PMD of 0.051 MGD and 0.600 MGD, respectively, from the Project Prairie Well in DeSoto County (currently operated by the Authority as established in the OFWUP).

2.1.2 Charlotte County

Charlotte County has two separate water service areas: the area north and west of the Peace River, which is served by water from the Authority's PRF, while the service area known as Burnt Store, located in the southwestern portion of the county and currently isolated from the remainder of the county and the Authority's regional system, is served by a county-owned and operated Burnt Store reverse osmosis (RO) facility. The Babcock Ranch Wellfield is also a permitted water supply source with a permitted annual allocation of 372 million gallons (approximately 1.0 MGD AAD) and a maximum monthly allocation of 93 million gallons (approximately 3.1 MGD PMD) through December 19, 2031; however, there are no existing water production or treatment facilities nor are there

currently any formal plans for construction of such facilities. Charlotte County plans to address this wellfield in their Potable Water Master Plan. Figure 2.2 shows the Charlotte County service area along with public water system interconnects, treatment, storage, and pumping facilities.

Figure 2.2 - Charlotte County Service Area



2.1.2.1 Water Supplied by the Authority

In accordance with the Second Amendment to the MWSC dated August 5, 2015, Charlotte County's contractual AAD and PMD public supply from the Authority are 16.100 and 19.320 MGD respectively. The County is authorized to use this water via WUP 20010420.009 (PRF), WUP 20012926.002 (OFWUP) and WUP 20007104.006 (Charlotte County Wholesale Permit). There is no significant loss associated with delivery of Authority water to the county so the contracted quantities are the same as the finished water capacity for purposes of this report.

Finished water is provided by the Authority to Charlotte County through various delivery points in the county service area at a minimum delivery pressure of 65 pounds per square inch (psi), as stated in the MWSC, at AAD demand conditions. Service to the county is through the following regional transmission mains (see Figure 2.2):

- 36-inch diameter Charlotte County Transmission Main

- 24-inch diameter Kings Highway RTM;
- 24-inch diameter Phase 1A Interconnect Pump Station on U.S. 17
- 42-inch diameter Phase 2 Regional Interconnect

2.1.2.2 Burnt Store Wellfield and WTP

The Burnt Store Wellfield and WTP is owned and operated by Charlotte County and is not currently interconnected with other public supply systems. The Burnt Store Wellfield is comprised of ten brackish groundwater wells located at the Burnt Store WTF and along Burnt Store Road in southern Charlotte County. The water source is brackish water from the Intermediate Aquifer System (IAS) and the Upper Floridian Aquifer (UFA).

The Burnt Store Wellfield is permitted for AAD and PMD withdrawals of 3.172 and 4.118 MGD, respectively (WUP 20003522.0012). The permit was issued on September 25, 2013 and expires on September 25, 2033. The groundwater is treated at the Burnt Store WTP which has a Florida Department of Environmental Protection (FDEP) permitted treatment capacity of 3.61 MGD, utilizing an RO system and is disinfected before storage in a 500,000 gallon ground storage tank and ultimate distribution to the system. Based on Charlotte County's 2017 Public Supply Annual Report (PSAR) for the Burnt Store Facility, the average treatment losses associated with the RO process were approximately 21%. This yields 2.506 and 3.253 MGD of finished water to meet demands on an AAD and PMD basis, respectively.

2.1.2.3 Babcock Ranch Wellfield

In 2011, Charlotte County was issued WUP No. 08-00129-W (Charlotte County Babcock Ranch Water) by the South Florida Water Management District. The permit authorizes an annual allocation of 372 million gallons (approximately 1.0 MGD AAD) and a maximum monthly allocation of 93 million gallons (approximately 3.1 MGD PMD) through December 19, 2031. No water production or treatment facilities currently exist, and no formal plans currently exist to construct such facilities within the 20 year IRWSP planning horizon. Charlotte County plans to address this wellfield in their Potable Water Master Plan. The Babcock Ranch Wellfield is not factored into the current available supply assessment.

2.1.2.4 Charlotte County Supply Capacity Summary

The total permitted and contracted AAD and PMD quantities available to the county from all sources are 19.272 and 22.875 MGD, respectively. When treatment losses are accounted for these quantities yield 18.606 and 22.573 MGD of AAD and PMD finished water capacity, respectively (see Table 2.1). However, the County's potable water supply system north of the Peace River which is served by the PRF is not interconnected with the County's potable water system south of the river



which is served by the Burnt Store Facility. This must be considered in evaluation of supply availability on local and regional basis.

Table 2.1 - Supply Capacity Available to Charlotte County

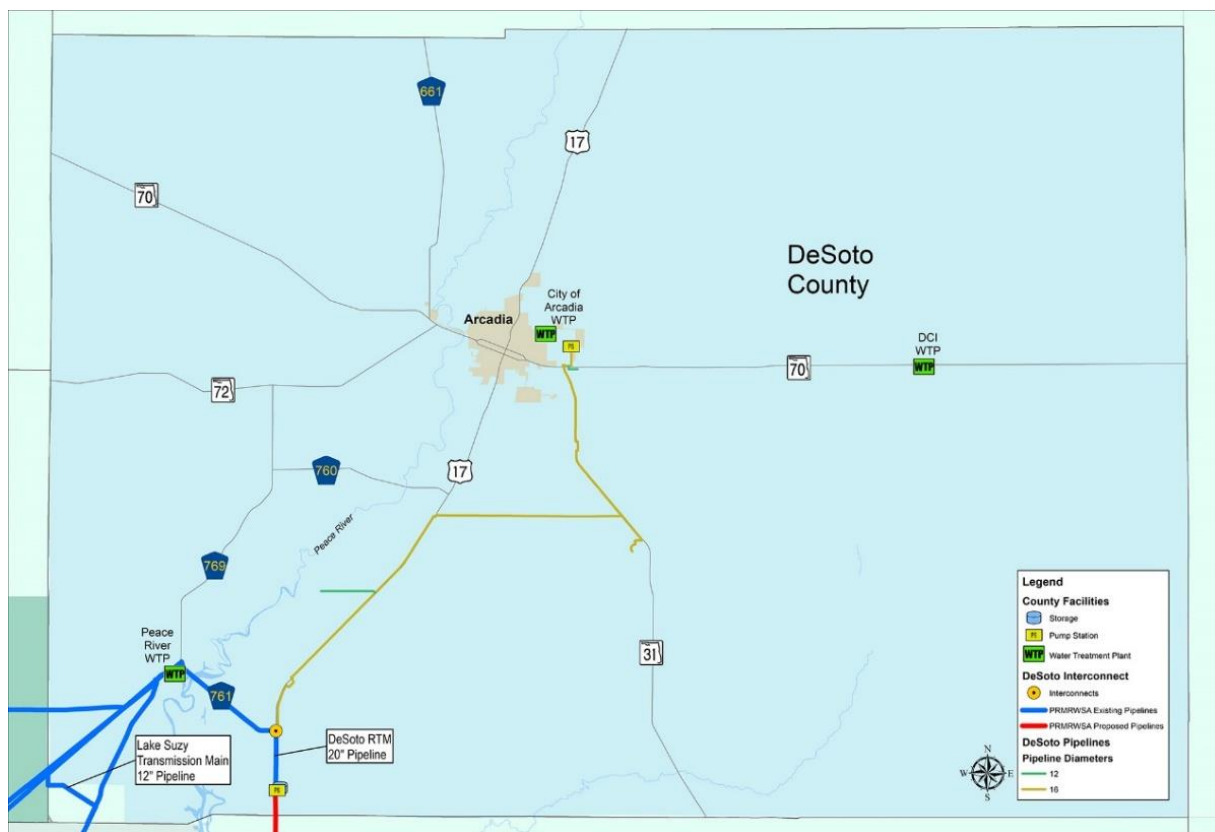
Supply (MGD)	2020		2025		2030		2035		2040	
	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>
Authority	16.100	19.320	16.100	19.320	16.100	19.320	16.100	19.320	16.100	19.320
Burnt Store Wellfield	2.506	3.253	2.506	3.253	2.506	3.253	2.506	3.253	2.506	3.253
Babcock Ranch Wellfield	No existing or planned facilities									
Totals	18.606	22.573	18.606	22.573	18.606	22.573	18.606	22.573	18.606	22.573

Note: Sources shown are permitted quantities adjusted for treatment losses. These represent the net quantity of supply available to meet current and future demands. Quantities shown in *italics* indicate that a permit renewal will be needed to secure the existing supply in the future.

2.1.3 DeSoto County

DeSoto County's water service area is currently divided and served by two separate sources. The largest of these is served through the county's interconnections to the Authority's regional supply system, and the other is a self-served system exclusively supplying the DeSoto Correctional Institute (DCI) and the Florida Civil Commitment Center from a groundwater RO facility. Figure 2.3 shows the DeSoto County service area along with public water system interconnects, treatment, storage, and pumping facilities.

Figure 2.3 - DeSoto County Service Area



Previous IRWSPs did not include plans for interconnecting the DCI to the regional system. However, the Authority now anticipates interconnection of DCI to the portion of DeSoto County’s system served by the PRF by about 2024. Total actual demand at DCI in recent years has been about 0.3 MGD AAD.

2.1.3.1 Water supplied by the Authority

By agreement, DeSoto County is an exclusive customer of the Authority and has committed to purchasing water from the Authority to meet its future water demands in unincorporated DeSoto County. The county is currently allocated up to 0.675 MGD and 0.810 MGD, respectively, from the Authority for AAD and PMD needs. However, because DeSoto County is an exclusive customer, the Authority is required to meet whatever water demand DeSoto County has, irrespective of the allocations listed above. The county is authorized to use this water via WUP No. 20010420.009 (PRF), WUP No. 20012926.002 (OFWUP), and WUP No. 20020457.001 (Wholesale WUP). There is no significant loss associated with delivery of Authority water to the county, so the contracted quantities are the same as the finished water capacity for purposes of this report.

Finished water is provided by the Authority to DeSoto County through various delivery points in the county service area delivery pressure of 65 pounds per square inch (psi), as stated in the MWSC, at AAD demand conditions. Service to the county is through the following regional transmission mains:

- 12-inch diameter Lake Suzy Transmission Main via connections to 36-inch Charlotte County and 42-inch Phase 2 RTM;
- 20-inch diameter DeSoto RTM

2.1.3.2 DeSoto Correctional Institute Wellfield

The DCI Wellfield is located east of US 17 on SR 70 at the DCI facility. This water supply is comprised of five brackish wells, an RO water treatment facility and 275,000 gallons of finished water storage capacity serving the potable water needs of the correctional facility. These production facilities are not currently connected with the remainder of the DeSoto County potable water supply system or the Authority's regional system.

The DCI RO Wellfield operates under WUP 20006841.011, issued by the SWFWMD on June 25, 2015 with an expiration date of June 25, 2035. This permit allows AAD and PMD daily withdrawals of 0.822 and 1.101 MGD, respectively. Brackish groundwater is treated at the DCI facility through the RO process with a finished water capacity of 0.750 MGD. Based on the county's 2009 PSAR for the DCI Facility, which is the most recent PSAR listed on the SWFWMD database, the average treatment losses associated with the RO process were approximately 15%. The AAD and PMD finished water quantities are 0.699 and 0.936 MGD, respectively.

2.1.3.3 DeSoto County Supply Capacity Summary

The total permitted/contracted AAD and PMD quantities available to the County are 1.497 and 1.887 MGD. Adjusted for treatment losses, the AAD and PMD finished water quantities available to the county total 1.374 and 1.746 MGD, respectively (see Table 2.2 below). However, the County's potable water supply system served by the PRF is not currently interconnected with the County's potable water supply at the DeSoto Correctional Institute. This must be considered in evaluation of supply availability on local and regional basis.

Table 2.2 - Supply Capacity Available to DeSoto County

Supply (MGD)	2020		2025		2030		2035		2040	
	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>
Authority	0.675	0.810	0.675	0.810	0.675	0.810	0.675	0.810	0.675	0.810
DCI Wellfield	0.699	0.936	0.699	0.936	0.699	0.936	0.699	0.936	0.699	0.936
Totals	1.374	1.746	1.374	1.746	1.374	1.746	1.374	1.746	1.374	1.746

Note: Sources shown are permitted quantities adjusted for treatment losses. These represent the net quantity of supply available to meet current and future demands. Quantities shown in *italics* indicate that a permit renewal will be needed to secure the existing supply in the future.

2.1.4 Manatee County

Manatee County supplies water to unincorporated areas in the county and also provides bulk water service to the cities of Bradenton and Palmetto, the Town of Longboat Key and Sarasota County. The county's current sources include the Lake Manatee Facility, comprised of the Lake Manatee Reservoir and an ASR system, the East County Wellfield and the IMC-Manatee Wellfields. A future RO wellfield, Buffalo Creek, has been permitted and is currently planned to begin development and use by 2033. The Lake Manatee Facility, the East County Wellfield and the Buffalo Creek Wellfield have all been permitted under the county's existing Consolidated WUP 20013343.004 issued by the SWFWMD on December 19, 2017 which expires September 25, 2032. Total permitted AAD and PMD quantities for the Consolidated WUP are 54.836 MGD and 70.374 MGD, respectively. The permitted AAD and PMD for the individual facilities authorized under the consolidated WUP are shown below.

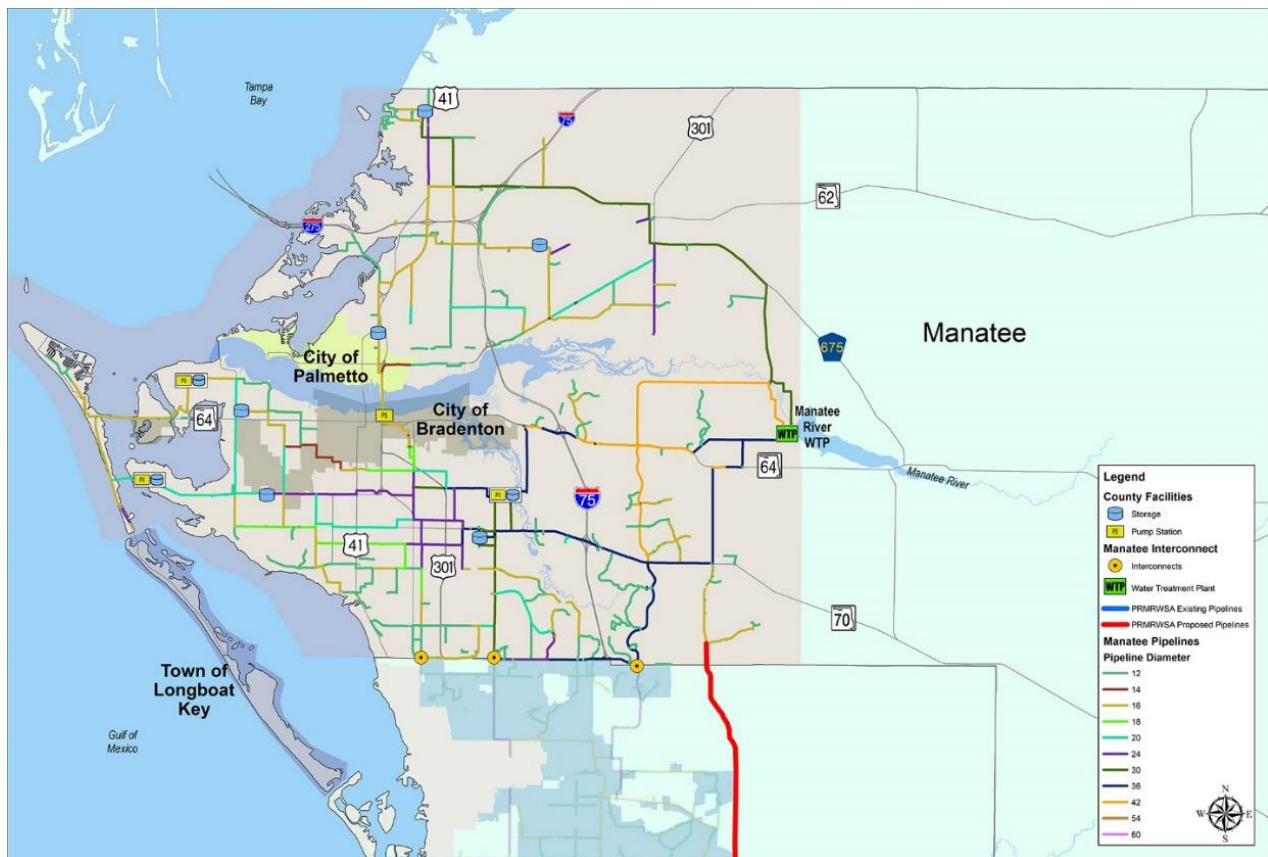
- Lake Manatee 34,900,000 gpd AAD 46,068,000 gpd PMD
- East County Wellfield 15,986,000 gpd AAD 20,356,000 gpd PMD
- Buffalo Creek Wellfield 3,950,000 gpd AAD 3,950,000 gpd PMD

The IMC-Manatee Wellfield is authorized under a separate permit (WUP 20007345.006) that was issued on December 12, 2017 and expires December 12, 2037. Authorized AAD and PMD quantities are both 1.960 MGD.

The total permitted AAD and PMD quantities associated with these four sources are 56.796 and 72.334 MGD. Historically, treatment losses from water produced at these facilities is less than 5%. For example, for water year 2017 Manatee County reported 1.265 MGD of losses associated with 39.458 MGD of total water produced in its PSAR to the SWFWMD. For purposes of this planning effort, these treatment losses are considered minimal, and finished water capacity is equal to permitted capacity. However, a treatment loss of 25% is included for the planned Buffalo Creek RO Wellfield yielding a finished water capacity of 3.0 MGD.

Manatee County does not currently receive water from the Authority, but as indicated in their 2018 Projected Water Demands and Sources of Supply, provided to the Authority on January 29, 2018, the County has indicated a need of up to 5 MGD AAD and PMD quantities of regional supply by 2037. As discussed in Section 1, depending upon the outcome of the District's MFL decision for the Manatee River, this schedule may need to be accelerated. Figure 2.4 shows the Manatee County service area along with public water system interconnects, treatment, storage, and pumping facilities.

Figure 2.4 - Manatee County Service Area



2.1.4.1 Lake Manatee Facility

Raw water from the Lake Manatee Reservoir is treated at the Lake Manatee WTP, which is a conventional surface water treatment facility using alum for coagulation. The permitted maximum day treatment capacity of the WTP is 84 MGD. The surface water units are designed to treat up to 54 MGD with conventional treatment. An additional 30 MGD of treatment is associated with the East County and IMC-Manatee Wellfields, which use degasification, lime softening, settling, and dual media filtration. The treated supply from both facilities is disinfected with chlorine followed by residual disinfection with chloramines.

ASR wells located at the WTP are used to inject treated drinking water into the UFA for storage during periods of low demand and high surface water flow. Currently, there are six ASR wells at the plant with a combined production capacity of 10 MGD. The ASR wellfield is permitted to maintain up to 3 billion gallons in storage. This storage is allocated with 1.8 billion gallons for operational purposes and 1.2 billion gallons reserved for extended operation (prolonged drought or maintenance) or emergency use. The Lake Manatee WTP also has one elevated storage tank with a 1 million gallon storage capacity, and two 10 million gallon ground storage tanks. Other storage in the system is provided via four 1 million gallon elevated storage tanks, one 0.5 million gallon elevated storage tank, three 1.5 million gallon ground storage tanks, and two 1 million gallon storage tanks. Total elevated storage equals 5.5 million gallons, and total ground storage equals 32 million gallons.

2.1.4.2 East Manatee County Wellfield

The East County Wellfield is located on an approximately 23,000 acre watershed conservation area owned by Manatee County in the eastern part of the county. It is comprised of seven production wells with combined permitted AAD and PMD quantities of 15.986 and 20.356 MGD. The County has offset approximately 4 MGD of historic agricultural groundwater withdrawals from Schroeder Manatee Ranch, Inc. with reclaimed water for residential irrigation at Lakewood Ranch, which has secured the, 3.1 MGD of groundwater credits for future use. Currently, this 3.1 MGD credit is conjunctive use, which requires the County to not increase their net water supply quantities until the demand grows such that they need additional capacity. The County's WUP is scheduled for review in 2021. At that time, the County expects that they will need to begin adding additional water supply capacity, and they will request to transition the 3.1 MGD credit from conjunctive use to additive use for groundwater withdrawal at the East County Wellfield in 2022. Because this permitted quantity has not been secured, the 3.1 MGD additional water supply is not included in Table 2.3 below.

2.1.4.3 Buffalo Creek Wellfield

Manatee County is planning to begin development of the Buffalo Creek RO Wellfield and associated WTP by 2028 with the intent to bring it online by 2033 (the ultimate timing for development will depend on water demand requirements and other considerations). The Buffalo Creek Wellfield is located in north-central Manatee County. This planned conjunctive use facility includes five wells to be completed into the UFA and eight wells completed in the IAS. Both the AAD and PMD authorized permitted quantities are 3.950 MGD. Treatment losses are expected to be approximately 25% yielding a finished water capacity of 3.0 MGD.



2.1.4.4 IMC-Manatee Wellfield

The IMC-Manatee Wellfield is located on a 994 acre tract owned by Manatee County 24 miles east of the City of Bradenton. The IMC-Manatee Wellfield is comprised of three production wells with AAD and PMD permitted quantities of 1.960 MGD.

2.1.4.5 Manatee County Supply Capacity Summary

Supply capacity available to Manatee County, taking into account treatment losses, during the 20 year planning period is shown in Table 2.3.

Table 2.3 - Supply Capacity Available to Manatee County

Supply (MGD)	2020		2025		2030		2035		2040	
	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>
Lake Manatee Facility ⁽¹⁾	34.900	46.068	34.900	46.068	34.900	46.068	<i>34.900</i>	<i>46.068</i>	<i>34.900</i>	<i>46.068</i>
East County Wellfield ⁽¹⁾	15.986	20.356	15.986	20.356	15.986	20.356	<i>15.986</i>	<i>20.356</i>	<i>15.986</i>	<i>20.356</i>
IMC-Manatee Wellfield ⁽¹⁾	1.960	1.960	1.960	1.960	1.960	1.960	1.960	1.960	1.960	1.960
Buffalo Creek Wellfield ⁽¹⁾							3.0	3.0	3.0	3.0
Water To Sarasota County ⁽²⁾	(5.000)	(5.000)								
Authority ⁽³⁾									5.0	5.0
Totals	47.846	63.384	52.846	68.384	52.846	68.384	55.846	71.384	60.846	76.384

Notes:

⁽¹⁾ Sources shown are permitted quantities adjusted for treatment losses. These represent the net quantity of supply available to meet current and future demands. Quantities shown in *italics* indicate that a permit renewal will be needed to secure the existing supply in the future.

⁽²⁾ The water contracted to Sarasota County is shown as a deduction in Manatee County's finished water supply capacity. Calendar year 2024 will be the last full year of commitment under the existing contract and for purposes of this plan, starting in 2025 the finished water capacity associated with this contract reverts back to Manatee County.

⁽³⁾ The 5 MGD to be provided by the Authority to Manatee County in 2040 may be required sooner depending upon the outcome of the District's MFL decision for the Manatee River.

2.1.5 Sarasota County

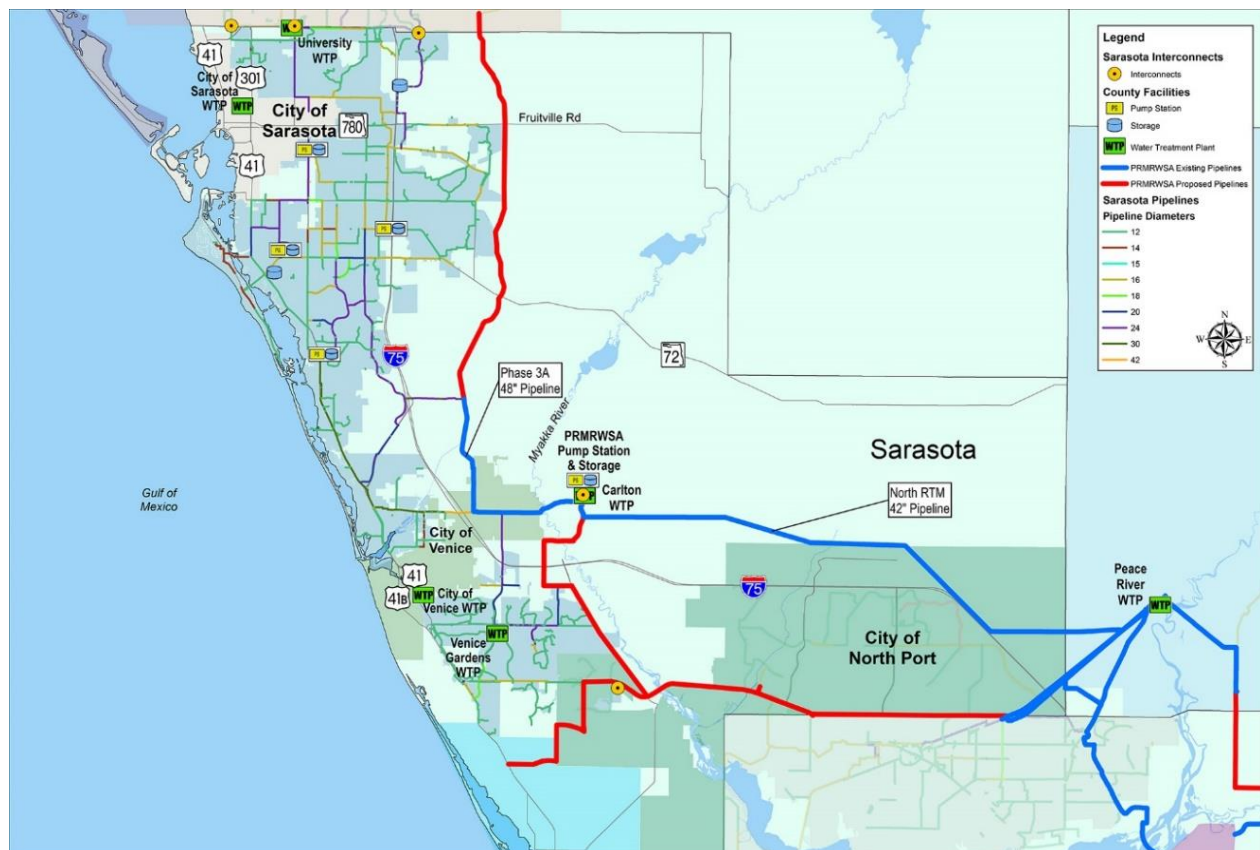
Sarasota County supplies potable water service to the unincorporated areas of the county. The county supply sources include water from the Authority (15.06 MGD AAD/18.084 MGD PMD), contract supply from Manatee County (5.0 MGD AAD and PMD; expires in 2025), and brackish groundwater from the Carlton Memorial Reserve, Venice Gardens, and University Parkway Wellfields, all located within Sarasota County. Withdrawals from the County's three wellfields are

authorized under WUP No. 20008336.013 (Sarasota County Consolidated WUP). WUP No. 20008836.013 authorizes total AAD and PMD quantities of 13.737 MGD and 16.499 MGD, respectively. AAD and PMD quantities authorized thereunder are as follows:

- Carlton Memorial Reserve Wellfield – 7.303 MGD AAD / 9.625 MGD PMD
- University Parkway Wellfield - 2.00 MGD AAD / 2.40 MGD PMD (which will decrease to 1.50 MGD AAD / 1.80 MGD PMD after 2025 due to it being phased out, and then will be reduced to zero by 2030)
- Venice Gardens Wellfield - 4.434 MGD AAD / 4.474 MGD PMD (which will reduce to zero by 2030).

These County facilities include fourteen ground storage tanks with a total combined storage capacity of 32 million gallons and two elevated storage tanks providing a total 2.25 million gallons of storage capacity. Figure 2.5 shows the Sarasota County service area along with public water system interconnects, treatment, storage, and pumping facilities.

Figure 2.5 - Sarasota County Service Area





2.1.5.1 Water Supplied by the Authority

Sarasota County's contractual AAD and PMD public supply quantities from the Authority are 15.060 MGD and 18.084 MGD, respectively. The County is authorized to use this water via WUP 20010420.010 (PRF) and WUP 20012926.002 (OFWUP). There is no significant loss associated with delivery of Authority water to the county so the contracted quantities are the same as the finished water capacity for purposes of this report.

Finished water is provided by the Authority to Sarasota County at the Carlton WTF and at the 681 Connection (immediately west of the county landfill on Knights Trail Road) at a minimum delivery pressure of 20 psi and 65 psi respectively, as stated in the MWSC, at AAD demand conditions. Service to the county is through the following regional transmission mains:

- 42-inch diameter North RTM;
- 48-inch diameter Phase 3A Interconnect

2.1.5.2 Water Supplied by Manatee County

Since 1973, Sarasota County has had a wholesale water service agreement with Manatee County for purchase of water. The latest version of this agreement was entered into by the counties on October 21, 2003, and remains in effect until March 31, 2025. The contract makes available to Sarasota County a maximum daily reserve capacity of 6.000 MGD through March of 2020, 5.000 MGD through March of 2025 and no quantity thereafter. This contract slowly decreases Sarasota County's purchase of water from Manatee County as the PRF increases capacity. The existing agreement identifies three water delivery locations, and a minimum static delivery pressure of 50 psi. There is a negligible loss associated with delivery of this water to the county so the contracted quantities are the same as the finished water capacity for purposes of this report.

2.1.5.3 University Parkway Wellfield

The University Parkway Wellfield is owned by Sarasota County and located in the northwest portion of the county. The wellfield supplies brackish groundwater for blending with potable water purchased from Manatee County. The University Parkway Wellfield consists of seven production wells which are completed in the UFA. WUP 20008836.013 allows an AAD withdrawal of 2.0 MGD and a PMD withdrawal of 2.4 MGD. The raw water is treated at the University Parkway WTP located at the site of Manatee County Interconnect #1 and Pump Station #1.

Water treatment at the University Parkway WTP consists of degasification and disinfection with chlorine and chloramines. The county then blends the treated water from the University Parkway WTP with potable water purchased from Manatee County at a blending ratio of about 1:5 (one part University Parkway Wellfield to five parts Manatee County supplied water) in order to achieve

compliance with drinking water standards. Due to this blending, current treatment losses are negligible. Until recently, current county projections indicated that 2.0 MGD would be expected to continue to be available from the University Parkway Wellfield after 2025 when the Manatee County contract expires, which would have required installation of either an additional blending source, such as extension of the regional pipeline to provide blend water to University Parkway Wellfield, or a treatment system such as RO to reduce mineralization. However, based on conversations between the Authority and Sarasota County, it is currently planned for University Wellfield to be phased out as a production unit in 2024. WUP quantities from University are proposed to be transferred to Carlton, although more production wells at Carlton may be needed to accommodate this.

2.1.5.4 Carlton Wellfield

The Carlton Wellfield and WTP are located in east central Sarasota County on the eastern side of the Myakka River on the 24,000 acre T. Mabry Carlton Jr. Reserve. The Carlton Wellfield consists of 16 production wells that withdraw water from the IAS and UFA. The Carlton WTP currently uses electro-dialysis reversal (EDR) technology to treat brackish ground water pumped from the Carlton Wellfield. The Carlton WTP also includes three ground storage tanks with a combined capacity of 15 million gallons (two of which are owned by the Authority).

The County's WUP 20008836.013 authorizes AAD and PMD quantities for the Carlton Wellfield of 7.303 and 9.625 MGD. However, Sarasota County's 2017 PSAR showed treatment losses of 34%, and therefore finished water AAD and PMD is estimated to be 4.820 and 6.353 MGD, respectively. As stated previously, the OFWUP (20012926.002) authorizes an additional 5.000 MGD of ground water from the Carlton Wellfield on a short-term basis (yielding 3.3 MGD of finished water assuming treatment losses of 34%), when the primary surface water source of the Authority is temporarily unavailable in part or whole. Because these are temporary quantities, they are not included in Table 2.4.

Based on conversations between the Authority and Sarasota County, it is noted that the Carlton Water Treatment Plant is being rehabilitated and upgraded in two phases. The water treatment plant (excluding the high service pumping) has been offline since July 2019. Phase 1 consists of replacing 5 EDR units, which will restore a design finished water capacity of 7.5 MGD. Phase 1 construction is anticipated to be complete in March 2021. Phase 2 consists of adding an additional 5 EDR units to bring the total design finished water capacity to 15 MGD. Phase 2 construction work for the Carlton EDR replacement will begin March 2021 and will be completed early 2023. It is anticipated that the county will rely on additional water supply from the Authority during Phase 1 and 2 construction. The county already has a contract to purchase the EDR units, and they anticipate the total construction cost for these Carlton WTP upgrades to be approximately \$50M.



2.1.5.5 Venice Gardens Wellfield

The Venice Gardens Wellfield is located in the southwestern region of Sarasota County and is comprised of ten permitted wells that utilize brackish water from the IAS and UFA. The current permitted AAD and PMD quantities are 4.434 and 4.475 MGD, respectively.

The total FDEP-authorized finished water capacity of the Venice Gardens WTP is currently 2.75 MGD. Currently, raw water is blended with RO product water at a ratio of approximately 1:5. Overall treatment losses are about 40% per the Sarasota County 2017 PSAR. The AAD and PMD finished water quantities are 2.660 and 2.684 MGD, respectively.

The Venice Gardens RO Facility is scheduled to be phased out as a production unit in 2030, or possibly sooner based on conversations with Sarasota County. WUP quantities from Venice Gardens are proposed to be transferred to Carlton, although more production wells at Carlton may be needed to accommodate this.

2.1.5.6 Sarasota County Supply Capacity Summary

There are no significant losses associated with the water Sarasota receives from the Authority and Manatee County, or from water derived from the University Parkway Wellfield, so for purposes of this plan no adjustments are made for treatment losses associated with these three supplies. Treatment losses of 34% and 40% were identified for the Carlton Memorial Reserve and Venice Gardens WTP, respectively, in the County's PSAR for 2017. Adjusting for these treatment losses, the total AAD and PMD finished water capacities from the Carlton Memorial Reserve and Venice Gardens Wellfields are 4.820 MGD/9.634 MGD, and 2.660 MGD/4.475 MGD, respectively. Therefore, the total available supply currently available to Sarasota County is 29.540 AAD and 34.521 PMD MGD. When the Manatee County contract expires in 2025, these are scheduled to decline to 24.040 AAD and 28.921 PMD. Supply capacity available to Sarasota County, taking treatment losses into account, during the 20 year planning period is shown in Table 2.4 below.

Table 2.4 - Supply Capacity Available to Sarasota County

Supply (MGD)	2020		2025		2030		2035		2040	
	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>
Authority	15.060	18.084	15.060	18.084	15.060	18.084	15.060	18.084	<i>15.060</i>	<i>18.084</i>
Water From Manatee County	5.000	5.000								
University Parkway Wellfield	2.000	2.400	1.500	1.800	<i>1.500</i>	<i>1.800</i>	<i>1.500</i>	<i>1.800</i>	<i>1.500</i>	<i>1.800</i>
Carlton Wellfield	4.820	6.353	4.820	6.353	<i>4.820</i>	<i>6.353</i>	<i>4.820</i>	<i>6.353</i>	<i>4.820</i>	<i>6.353</i>
Venice Gardens Wellfield	2.660	2.684	2.660	2.684	<i>2.660</i>	<i>2.684</i>	<i>2.660</i>	<i>2.684</i>	<i>2.660</i>	<i>2.684</i>
Totals	29.540	34.521	24.040	28.921	24.040	28.921	24.040	28.921	24.040	28.921

Note: Sources shown are permitted quantities adjusted for treatment losses. These represent the net quantity of supply available to meet current and future demands. Quantities shown in *italics* indicate that a permit renewal will be needed to secure the existing supply in the future. The water contracted from Manatee County is shown as an addition to Sarasota County's finished water supply capacity until the 2025 contract expiration.

2.1.6 City of North Port

The City of North Port, located in Sarasota County, currently supplies potable through the use of three water sources. These sources include Myakkahatchee Creek (and the Cocoplum Waterway), an IAS brackish water wellfield (Myakkahatchee Creek RO Wellfield) and wholesale water supplied by the Authority. A fourth source, the West Villages RO Wellfield (also authorized to withdraw from the IAS), is proposed and authorized under the City's current WUP. SWFWMD adopted an MFL for the lower segment of the Myakka River, which includes the Myakkahatchee Creek. The adopted MFL includes the permitted flows for the City of North Port; however, this MFL could potentially limit future growth of this surface water source.

The City's WUP No. 20002923.013, issued by the SWFWMD on April 08, 2011 (Modification 20002923.014 on October 5, 2016) has an expiration date of September 22, 2030, and allows for conjunctive use of surface water and groundwater at an AAD withdrawal rate of 7.1 MGD and a PMD rate of 8.7 MGD. The permit stipulates that up to 4.4 MGD on an AAD basis, and up to 6.0 MGD on a PMD basis, is allowed from the Myakkahatchee Creek or a combination of the Myakkahatchee Creek and Myakkahatchee Creek RO wellfield withdrawals. The additional 2.7 MGD AAD and PMD withdrawal is permitted from the proposed West Villages RO Wellfield. Withdrawal from Myakkahatchee Creek is regulated to ensure compliance with a diversion schedule, which was established to protect the creek from dropping below the SWFWMD established MFLs. It is noted

that the West Villages RO Wellfield wells were constructed but are currently capped. There are no treatment, storage or pumping facilities, or public supply use associated with this source, however the City has indicated in their 2019 Annual Demand Projections that the West Village (southwest) WTP will be online in 2022. Figure 2.6 shows the City of North Port service area along with public water system interconnects, treatment, storage, and pumping facilities.

Figure 2.6 - City of North Port Service Area



2.1.6.1 Water Supplied by the Authority

The City of North Port's contractual AAD and PMD public supply from the Authority is currently 2.865 and 3.438 MGD. The City is authorized to use this water via WUP 20010240.010 (PRF) and WUP 20012926.002 (OFWUP). There is no loss associated with delivery of Authority water to the city, so the contracted quantities are the same as the finished water capacity for purposes of this report.

Finished water is provided by the Authority to the City of North Port through various delivery points in the service area with delivery pressures at AAD demand conditions of 65 pounds per square inch (psi), as stated in the MWSC. Service is through the following regional transmission mains:

- 42-inch Phase 2 RTM;
- 36-inch diameter South RTM

2.1.6.2 Myakkahatchee Creek / Cocoplum Waterway

North Port withdrawals of surface water from Myakkahatchee Creek, brackish ground water from the IAS to supply the existing RO facilities, and future brackish withdrawals to supply the West Villages RO facilities are regulated under WUP 20002923.014. Withdrawals from the creek are regulated according to a specified diversion schedule. Withdrawals are not allowed to exceed 2.08 MGD, 4.0 MGD, and 6.0 MGD when flow as measured at the City's gauge station USGS Price Blvd., District ID No. 202, is less than 10 cfs, between 10 and 30 cfs, and greater than 30 cfs, respectively. Water quality (total dissolved solids and sulfates increase) in Myakkahatchee Creek degrades during periods of low rainfall, which can further reduce withdrawals. The WUP also allows the City to withdraw water from the Cocoplum Waterway (located adjacent to the Water Treatment Facility) on a rotational basis while complying with the AAD and PMD quantities of 4.400 MGD and 6.000 MGD. The water quality of the Cocoplum waterway is lower than Myakkahatchee Creek; however, there are no withdrawal limitations for the waterway based on flow rates.

In 2013, the city developed the Myakkahatchee Creek RO Wellfield which produces brackish ground water from six production wells completed in the IAS with a total depth of about 320 feet. One of the wells are located at the Myakkahatchee Creek WTP site, and five of the wells are located east of, and adjacent to, the Myakkahatchee Creek WTP site. The six wells are permitted to withdraw up to a combined total of 2.000 MGD on an AAD and PMD basis. The RO treatment component of the WTP has a 75% treatment efficiency, which yields 1.500 MGD of finished water prior to blending and storage.

Finished water from the surface WTP is blended with RO treated ground water from the Myakkahatchee RO Wellfield, and transferred to ground storage tanks prior to being pumped to the distribution system. As stated in the City's demand projections, the combined AAD and PMD capacities from these two treatment processes are 3.300 and 3.960 MGD, respectively. This is considered the finished water capacity until additional treatment capacity is added.

2.1.6.3 West Villages RO Wellfield

Another proposed groundwater RO source already authorized in the City's WUP, but not yet in service, is located at the West Villages development and is permitted to withdraw up to 2.7 MGD on an AAD and PMD basis. According to the City's December 2018 submittal to the Authority regarding projected demands, the West Villages Wellfield has yet to be fully constructed and is not projected to begin to supply water until approximately 2022 (although the ultimate timing of development is



dependent on water demand requirements and other considerations). For purposes of this report it is assumed that there will be treatment losses of 25% associated with the West Villages RO Wellfield; therefore, the AAD and PMD capacity are both 2.025 MGD.

The City's demand projections indicated that the West Villages WTP finished water capacity would be expanded to 3.0 mgd by 2034; however, additional WUP withdrawal quantities to achieve this finished water capacity have not been permitted. Thus, this additional finished water capacity is not included in the supply capacity available to the City in Table 2.5 below.

2.1.6.4 City of North Port Supply Capacity Summary

There is no treatment loss associated with the water North Port receives from the Authority. However, the City has indicated in their 2019 annual demand projections submittal to the Authority that the AAD and PMD finished water capacities at the Myakkahatchee Creek Facility, including both the surface water and RO facility are 4.400 and 5.28 MGD, respectively. The RO facility has a 75% treatment efficiency. Adjusting for the capacity limitations at the Myakkahatchee Creek WTP, the total ADD and PMD finished water capacities currently available to North Port are 6.165 and 7.398 MGD, respectively and increase to 8.190 and 9.423 MGD in 2025 (although this date is subject to change based on demand requirements and other considerations), upon completion of the West Village RO Wellfield facilities. Supply capacity available to The City of North Port, taking treatment losses into account, during the 20 year planning period is shown in Table 2.5.

Table 2.5 - Supply Capacity Available to the City of North Port

Supply (MGD)	2020		2025		2030		2035		2040	
	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>
Authority	2.865	3.438	2.865	3.438	2.865	3.438	2.865	3.438	2.865	3.438
Myakkahatchee Creek Facility	3.300	3.960	3.300	3.960	3.300	3.960	3.300	3.960	3.300	3.960
West Villages RO Wellfield*			2.025	2.025	2.025	2.025	2.025	2.025	2.025	2.025
Totals	6.165	7.398	8.190	9.423	8.190	9.423	8.190	9.423	8.190	9.423

Note: Sources shown are permitted quantities adjusted for treatment losses. These represent the net quantity of supply available to meet current and future demands. Quantities shown in *italics* indicate that a permit renewal will be needed to secure the existing supply in the future.* Quantities shown for the West Villages RO system will require construction of treatment facilities.

2.1.7 City of Punta Gorda

Punta Gorda's water supply is produced at the Shell Creek WTP on Washington Loop Road. The permitted treatment capacity of the facility is 10 MGD. Water is supplied to the treatment facilities from the Shell Creek Reservoir, which covers about 800 acres and has a capacity of 765 million

gallons. MFLs were proposed in 2010 for the lower segment of Shell Creek, just downstream of the reservoir, and SWFWMD is in the process of adopting MFLs by 2022. Upstream of the reservoir, SWFWMD is in the process of adopting MFLs by 2025 for the upper segment of Shell Creek and Prairie Creek. The reservoir is formed from impoundment of Shell and Prairie Creeks by the Hendrickson Dam.

The City also has a two-well ASR system at the Shell Creek Facility. The ASR wells are used to store excess treated water when it's available. That stored water is recovered as needed to augment the raw water supply from the reservoir. Recharge rates for the individual ASR wells are on the order of 1.4 MGD; however, the recovery rates are operationally limited to about 1 MGD for each well, subsequently limiting the supplemental water supply to 2 MGD. The 2 MGD recovery rate is limited in durations and insufficient to meet the city's extended needs. The City is currently in the process of modifying its WUP to convert these ASR wells into groundwater production wells for use with the RO facility currently in construction.

The City of Punta Gorda's distribution system is interconnected to the PRF through the 9-mile, 24-inch Phase 1A regional interconnect. This interconnect has the capacity to deliver up to 6 MGD from the Authority to the City and the flow can be reversed to allow the city to provide the Authority supply in times of need. The City's distribution system contains the Burnt Store Isles Elevated Storage Tank and the Punta Gorda Isles Ground Storage Tank, which provide 20,000 gallons and 50,000 gallons of storage respectively.

The City operates under WUP 20000871.011, which was issued January 8, 2018 and has an expiration date of July 31, 2027. This permit allows AAD and PMD withdrawals of 8.088 and 11.728 MGD, respectively. This permit authorized the City to add a brackish wellfield supply for conjunctive use with the existing surface water source. The City's Shell Creek Reservoir is also an authorized source for serving the region under the OFWUP 20012926.002. Authorized AAD and PMD withdrawal quantities for Shell Creek under the OFWUP are 2.2 MGD and 6.0 MGD, respectively. Additional volumes of surface water from Shell Creek are available under appropriate hydrologic conditions in accordance with special conditions of the WUPs.

Raw water withdrawn from the Shell Creek Reservoir is treated at the Shell Creek WTP, located east of Interstate-75 on Washington Loop Road. The City's WTP is permitted by the FDEP for 10 MGD of treatment capacity. Treatment losses for the surface water treatment plant are considered negligible, which results in the finished water capacity equaling the permitted WUP quantities of 8.088 and 11.728 MGD on an AAD and PMD basis, respectively (see Table 2.6).

The City of Punta Gorda is also currently constructing a new RO WTP which is scheduled to be complete in spring of 2020. Under FDEP Permit No. 284554-002, the City was authorized to



construct a 4.0 MGD ROWTP with the capability of blending up to 0.5 MGD of filtered groundwater for a design capacity of 4.5 MGD. The proposed ROWTP will be located adjacent to the City's existing Shell Creek WTP.

Supply capacity available to Punta Gorda, taking treatment losses into account, during the 20 year planning period is shown in Table 2.6.

Table 2.6 - Supply Capacity Available to the City of Punta Gorda

Supply (MGD)	2020		2025		2030		2035		2040	
	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>
Shell Creek Reservoir and RO Wellfield	8.088	11.728	8.088	11.728	8.088	11.728	8.088	11.728	8.088	11.728

Note: Sources shown are permitted quantities adjusted for treatment losses. These represent the net quantity of supply available to meet current and future demands. Quantities shown in *italics* indicate that a permit renewal will be needed to secure the existing supply in the future.

2.1.8 Englewood Water District

The EWD provides potable water service to southwestern Sarasota County and northwestern Charlotte County from a number of wellfields supplying both lime softening and RO treatment facilities. The EWD lime softening WTP has a finished treatment capacity of 2.5 MGD. Treatment losses are minimal, therefore, finished water capacity of the lime softening WTP is assumed to equal the permitted freshwater withdrawal quantity. EWD distribution system has four storage tanks with a combined capacity of 7.5 million gallons, plus a 150 foot elevated storage tank of 0.1 million gallon capacity for additional storage.

The RO WTP treats brackish groundwater from two IAS wellfields. The RO WTP currently has a finished water production capacity of 3.0 MGD using six membrane trains each capable of producing 0.5. Treatment losses are estimated at about 30% from this system.

The EWD wellfields are permitted under WUP 20004866.010, which was issued on June 15, 2011 and expires on December 18, 2019. EWD's WUP allows for raw water withdrawals of 5.36 MGD AAD and 6.59 MGD PMD from four individual wellfields and one conjunctive use wellfield. Wellfields 1, 2, 3, and 5, withdraw from the SAS and Permeable Zone 1 (PZ1) of the IAS, and provide raw freshwater for a lime softening WTP. Permitted AAD and PMD daily quantities from this collection of wellfields are 1.360 MGD and 2.190 MGD, respectively. RO Wellfield 4 and RO Wellfield 2 (which are located within the limits of freshwater Wellfield 2) provide raw brackish ground water from Permeable Zone 3 (PZ3) of the IAS for the RO WTP. Combined withdrawals from RO Wellfields 2 and 4 are limited to 4.000 MGD AAD and 4.400 MGD PMD.

Under the OFWUP, up to 2.0 MGD of finished water may be supplied by EWD to the region on an AAD and PMD basis. The OFWUP quantities identified for EWD are not in addition to those contained within EWD's WUP (i.e., no additional withdrawals are authorized by the OFWUP). Rather, the quantities authorized represent excess finished water capacity that is authorized to be provided by EWD to the region as long as EWD's permitted quantities are not exceeded. EWD supplies are currently available through two interconnections between EWD and Charlotte and Sarasota Counties.

Considering the WUP limits on groundwater withdrawals serving the lime softening facility and losses through the RO treatment process of approximately 30%, the AAD and PMD finished water quantities are shown in Table 2.7.

Table 2.7 - Supply Capacity Available to the Englewood Water District

Supply (MGD)	2020		2025		2030		2035		2040	
	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>
Englewood Wellfield	4.160	5.190	4.160	5.190	4.160	5.190	4.160	5.190	4.160	5.190

Note: Sources shown are permitted quantities adjusted for treatment losses. These represent the net quantity of supply available to meet current and future demands. Quantities shown in *italics* indicate that a permit renewal will be needed to secure the existing supply in the future.

2.1.9 City of Sarasota

The City of Sarasota's water supply comes from two groundwater sources: the Verna Wellfield and the Downtown Reverse Osmosis (RO) Wellfield. The Verna Wellfield (WUP No. 204318.006) allows AAD and PMD withdrawals of 6.0 and 7.0 MGD, respectively. Groundwater withdrawn from the Verna Wellfield is aerated, chlorinated, and retained in a 1 MG ground storage reservoir. It is pumped to the City's water treatment plant where approximately 70% of it is further treated with ion exchange and re-blended with the other 30% of the water.

The Downtown RO wellfield (WUP No. 2010224.004) allows AAD and PMD withdrawals of 6.0 and 6.5 MGD, respectively. Treatment from the RO facility has a 25% loss, yielding a production capacity of 4.5 MGD AAD and 4.875 MGD PMD of finished water. The RO-treated water is then blended with the Verna wellfield treatment stream to provide a final blend that is chlorinated and pumped to storage. The final blend finished water capacity from this water treatment facility is 10.5 MGD AAD and 11.875 MGD PMD. The water distribution system consists of two elevated storage tanks with a combined capacity of 500,000 gallons. Booster pumping stations combined with ground storage provide an additional 6.5 million gallons of storage within the system.



The City also has a third WUP (WUP 2010225.003) for four groundwater wells that are located at the Bobby Jones Golf Course. The permit authorizes standby quantities of 43,000 gpd AAD and 64,500 gpd PMD for the Verna Wellfield. Therefore, these additional flows are not additive to the total supply capacity of the City of Sarasota.

Supply capacity available to the City of Sarasota, taking treatment losses into account, during the 20 year planning period is shown in Table 2.8.

Table 2.8 - Supply Capacity Available to the City of Sarasota

Supply(MGD)	2020		2025		2030		2035		2040	
	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>	<i>Avg.</i>	<i>Peak</i>
Verna Wellfield (and Bobby Jones Wellfield on standby)	6.000	7.000	6.000	7.000	6.000	7.000	6.000	7.000	6.000	7.000
Downtown RO Wellfield	4.500	4.875	4.500	4.875	4.500	4.875	4.500	4.875	4.500	4.875
Totals	10.500	11.875	10.500	11.875	10.500	11.875	10.500	11.875	10.500	11.875

Note: Sources shown are permitted quantities adjusted for treatment losses. These represent the net quantity of supply available to meet current and future demands. Quantities shown in *italics* indicate that a permit renewal will be needed to secure the existing supply in the future.

2.1.10 City of Bradenton

The Bill Evers Reservoir, a 1.5 billion gallon reservoir created by a low head dam on the Braden River and located approximately five miles east and four miles south of downtown Bradenton, is the main source of water for the City. SWFWMD currently has adopted MFLs for the upper segment of the Braden River, which includes the reservoir near the downstream end of the segment. SWFWMD is scheduled to adopt MFLs for the lower segment of the Braden River by 2021. The City currently holds one WUP permit, WUP No. 20006392.005, which allows for raw water withdrawals of 6.950 MGD AAD and 8.130 MGD PMD. The WUP expired at the end of April 2018; however, the City submitted a permit renewal application in April 2018 and requested raw water withdrawals of 8.86 MGD AAD and 14.81 MGD PMD in order to incorporate existing and planned potable water ASR wells. The City's water treatment plant is a conventional surface/groundwater facility with a rated capacity of 12 MGD. The City contains ground storage tanks as well as six elevated storage tanks within the distribution system.

2.1.11 City of Venice

The City of Venice currently holds one WUP (WUP No. 20005393.010), which allows for raw water withdrawals of 6.864 MGD AAD and 8.240 MGD PMD. The City currently owns and operates a

brackish groundwater ROWTP. The WTP has a rated capacity of 4.48 MGD and currently operates at an overall recovery rate of 50%. At 50% efficiency, the City can produce AAD and PMD quantities of 3.432 MGD and 4.120 MGD, respectively. The City has plans to make improvements to the RO facility (Second Stage Membrane Addition) and anticipates higher recovery rates that would potentially yield up to 5.5 MGD. These improvements are planned to be completed in late 2021. The ROWTP contains a 1 million gallon covered clearwell for finished water. The City's distribution system contains a 1.5 million gallon ground storage tank with booster pump station and two 300,000 gallon elevated storage tanks.

2.1.12 City of Arcadia

The City of Arcadia currently holds one WUP (WUP 20004725.008) which allows for groundwater withdrawals of 1.093 MGD AAD and 1.235 MGD PMD. In 2014, the City completed construction of a new 1.5 MGD permitted design capacity ion exchange WTP to replace their old lime softening facility. Though the City is neither an Authority Customer nor Partner, the City has an interconnect and a contract with DeSoto County to purchase up to 0.2 MGD from the County for distribution to the City's customers.

2.2 Current Projected Regional Water Supply Capacity

Table 2.9 summarizes the total AAD and PMD finished water capacities of the Authority's Customers through 2040. The AAD and PMD quantities associated with the PRF represent a significant share of the region's finished water capacity. However, because these quantities are included in Charlotte, DeSoto and Sarasota County's, and the City of North Port's finished water capacities, AAD and PMD quantities associated with the PRF are not separately shown in this table to avoid duplication.

Finished water capacity of the planned Buffalo Creek and West Village Wellfields scheduled to be operational in 2033 and 2025 respectively, are also included.

Table 2.9 - Permitted Capacity Available to Authority Customers

Supply (MGD)	2020		2025		2030		2035		2040	
	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak	Avg.	Peak
Charlotte	18.606	22.573	18.606	22.573	18.606	22.573	18.606	22.573	18.606	22.573
DeSoto	1.374	1.746	1.374	1.746	1.374	1.746	1.374	1.746	1.374	1.746
Manatee	47.846	63.384	52.846	68.384	52.846	68.384	55.846	71.384	60.846	76.384
Sarasota	29.540	34.521	24.040	28.921	24.040	28.921	24.040	28.921	24.040	28.921
North Port	6.165	7.398	8.190	9.423	8.190	9.423	8.190	9.423	8.190	9.423
Totals	103.531	129.622	105.056	131.047	105.056	131.047	108.056	134.047	113.056	139.047

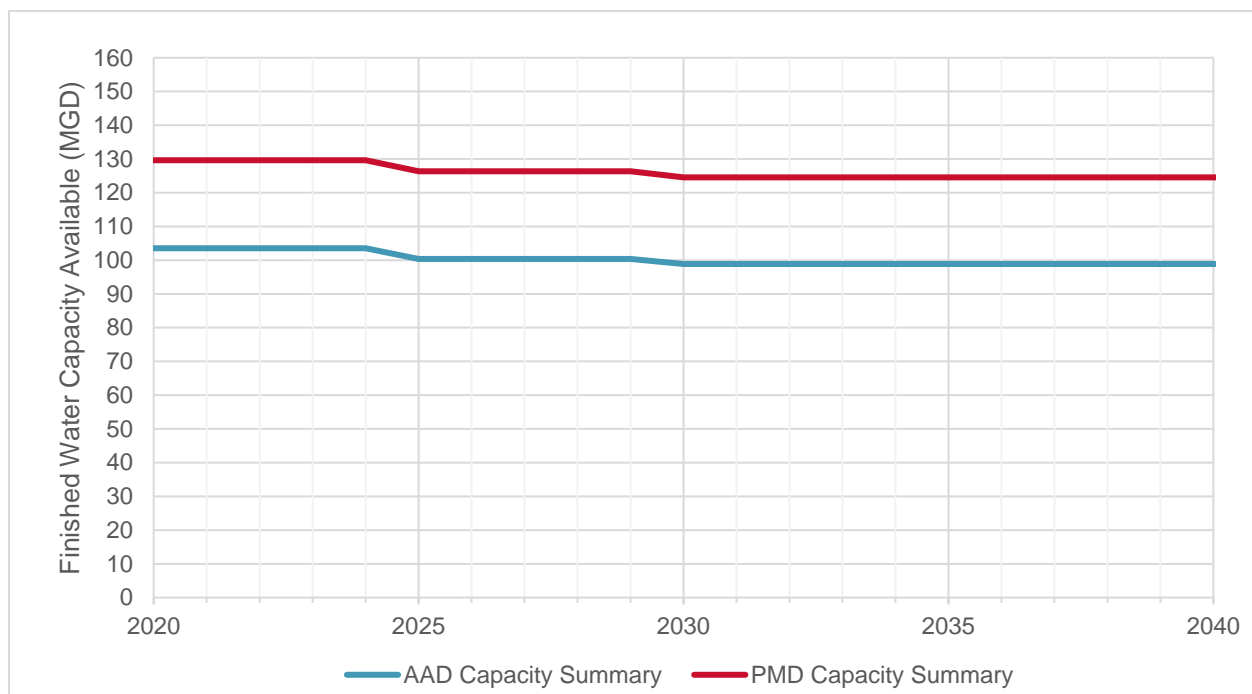


Note: Sources shown are permitted withdrawal quantities adjusted for treatment losses. These represent the net quantity of supply available to meet current and future demands irrespective of interconnectivity..

As illustrated in Table 2.9, the AAD finished water capacity available to the Authority Customers is currently 103.5 MGD with additional permitted capacity up to 113 MGD through 2040. The PMD finished water capacity in the region associated with currently permitted facilities is about 130 MGD with additional permitted capacity up to 139 MGD through 2040. However, there are plans to decommission Sarasota County's University Parkway Water Treatment Plant (WTP), with a finished water capacity of 2.0 MGD AAD and 2.4 MGD PMD, by 2025 when the delivery contract with Manatee County expires. Similarly, Sarasota County's Venice Gardens WTP, with a finished water capacity of 2.66 MGD AAD and 2.68 MGD PMD, is expected to be derated by 2025 to a finished water capacity of 1.5 MGD AAD and 1.8 MGD PMD, and it is expected to be decommissioned by 2030 due to saltwater intrusion of its supply wellfield. This culminates in a finished water capacity of 98.9 MGD AAD between the Authority and its Customers by 2040.

The permitted quantities above also include the North Port West Villages RO WTP and the Manatee County Buffalo Creek RO WTP that have not been constructed yet. The opportunities to utilize these quantities for finished water development are considered further, along with other potential water supply development opportunities, in Section 4. Thus, the finished water capacity available to Authority Customers is shown in Figure 2.7.

Figure 2.7 – Finished Water Capacity Available to Authority Customers



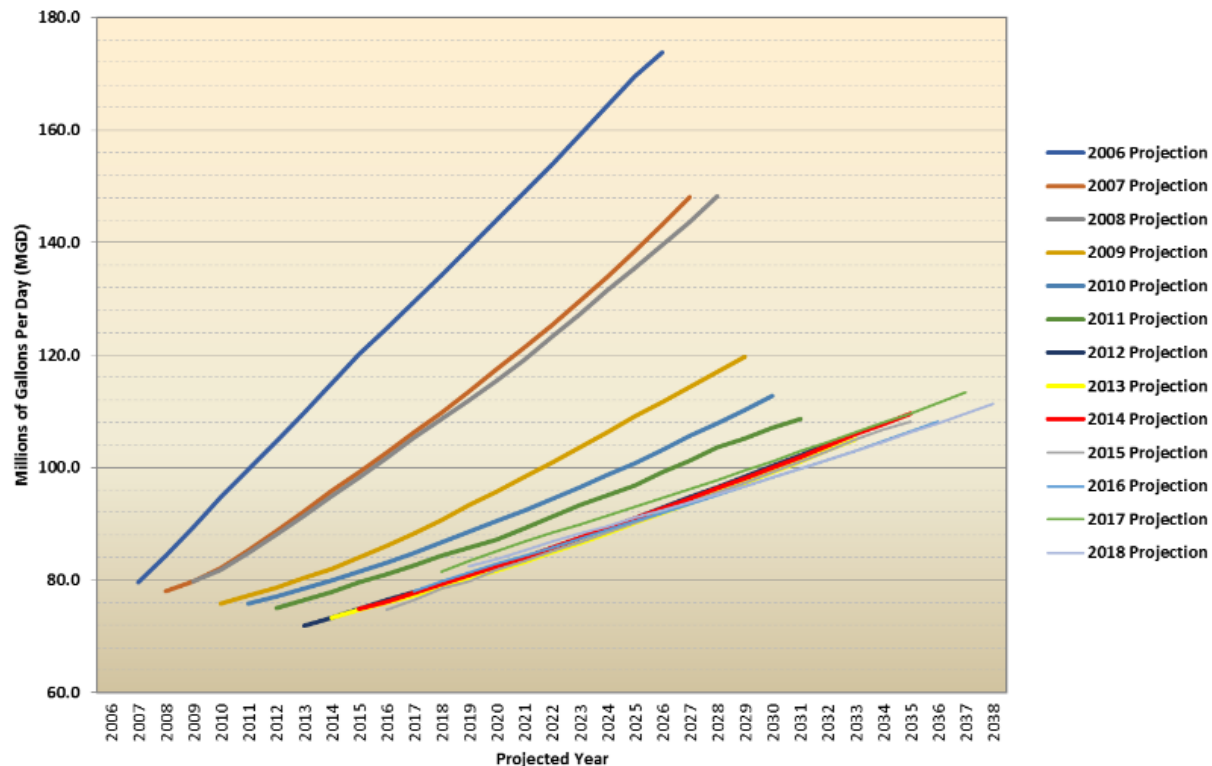
The AAD finished water capacity shown in Figure 2.6 is a critical element to this 2020 Plan as these capacities are compared to the projected water demands in Section 3 to estimate future regional water supply needs.

The AAD finished water capacity for the City of Punta Gorda and the EWD described above will be further discussed in Section 7, which explores additional opportunities to share excess capacity.

3 Demand Projection Update

Demand projections serve as the foundation for long-term water supply planning. Projections of future water demands inherently includes a degree of uncertainty, and a variety of demand projection techniques are employed across the region by individual utilities and the Southwest Florida Water Management District (SWFWMD), with each providing different results. The degree of uncertainty can be illustrated by comparing historic demand projections with actual water use. For example, in 2006 the aggregate projected demand by the Authority's Members and Customers for 2018 was 134.25 MGD (Figure 3.1). However, actual use from the regionally-interconnected system in FY2018 was only 69.58 MGD, a value 64.67 MGD (48%) less than predicted.

Figure 3.1 - Total Regional 20-Year Demand Projection Comparison (2006-2018)



As illustrated in Figure 3.1, the magnitude of Authority Customer-projected demand increases has been substantially reduced and demand projections in recent years have been more consistent.

Over-prediction of demands can potentially lead to premature investment in expensive infrastructure resulting in undesirable economic consequences while under-prediction can lead to water shortages, building moratoriums, and the like. Therefore, it is important to consider a variety of demand-related



information to bracket a range of potential demand scenarios so that utilities can carefully plan for timely development of water supplies.

Two critical elements are needed to develop reasonable projections of water demand:

- Use of reasonable annualized water use growth rates
- Use of an appropriate baseline (starting point) demand condition

The following seven methodologies were utilized in preparing the 20-year demand projections for Authority Members and Customers in order to bracket a range of potential regional demand projections for the 2020-2040 planning period.

1. *Customer 2018:*

This demand projection methodology adopts the aggregate regional 20-year water demand projections submitted to the Authority by its Customers in 2018.

2. *Customer 2018 Adjusted:*

This demand projection methodology adjusts the starting point (baseline) for Customer 2018 to regional FY2018 actual use (69.58 MGD) while employing the Customer 2018 annualized growth rate of 1.69%/year.

3. *Authority Actual Use (FY2010-FY2018):*

This demand projection methodology also employs regional FY2018 actual use (69.58 MGD) as a baseline and projects demands at the annualized actual regional use growth rate for the FY2010-FY2018 period (1.60%/year).

4. *BEBR High Projection:*

This demand projection methodology applies the University of Florida's Bureau of Economic and Business Research's (BEBR) projected "High" population growth rate for 2020-2040 (1.98%/year) for Charlotte, DeSoto, Manatee and Sarasota Counties (i.e. the Authority's four-County area) using regional FY2018 actual use (69.58 MGD) as a baseline.

5. *BEBR Medium Projection:*

This demand projection methodology applies BEBR's projected "Medium" population growth rate for 2020-2040 (1.22%/year) for the Authority's four-County area using regional FY2018 actual use (69.58 MGD) as a baseline.

6. *BEBR-Estimated Population Growth – Last 20 years (1998-2018):*

This demand projection methodology applies BEBR's historic annualized population growth rate (1.90%/year) for the Authority's four-County area for the last 20 years (1998-2018) (69.58 MGD) as the baseline for projections.

7. *SWFWMD Draft Regional Water Supply Plan (RWSP) 2020:*

This demand projection methodology is that utilized by the SWFWMD to project 2020-2040 demands for the Authority's Members and Customers in the SWFWMD's Draft RWSP 2020 Projections (June 2018).

These seven methodologies yield aggregate regional projected 2040 demands ranging from 87.24 MGD (SWFWMD 2018) to 118.83 MGD (Customer 2018), respectively. The lowest projected demand (SWFWMD 2018) is 31.59 MGD (27%) less than the highest projected demand (Customer 2018), illustrating the degree to which demand projection results can vary. Ultimately, the highest and lowest demand projection values were removed from consideration, and the demands resulting from the five other methodologies were reviewed to identify the "Most Probable Range of Demands" and a single "Most Probable Demand" for the 2020-2040 planning period.

The 2040 demand projections for the "Most Probable Range of Demands" ranges from 90.85 MGD (BEBR Medium) to 107.11 MGD (BEBR High), respectively, which narrows the difference between the lowest and highest projected demand down from 31.59 MGD to 16.26 MGD. The selected single "Most Probable Demand" for the 2020-2040 period represents the numeric median of the upper and lower end of the Most Probable Range of Demands. The projected Most Probable Demand for 2040 is 98.98 MGD. This demand value does not include the Authority's "6% Rotational Reserve Capacity" or "90% Capacity Standard" Best Management Practices (BMPs), which are collectively referred to later within this document as the "17% Capacity Standard".

In addition to projecting 20-year demands for Authority Members and Customers as described above, this Section also provides:

- The projected total finished capacity required to comply with the Authority's "17% Capacity Standard" for the identified Most Probable Demand scenario.
- 20-year demand projections for other non-members within the Authority's four-county region who are not Authority Members and Customers.
- 50-year demand projections (2020-2070) for Authority Members and Customers and for other non-members.

Details of the demand projections presented in this Demand Projection Update are provided in Appendix A.



3.1 20-Year Demand Projections

This Section provides the 20-year demand projections for the 2020-2040 planning period for Authority Members and Customers and for other non-members within the Authority's four-county region.

3.1.1 "Customer 2018" 20-Year Demand Projections (2020-2040)

Demand projections are provided annually to the Authority by Members and Customers in accordance with the October 5, 2005 MWSC's Section 11, "Future Water Supply Procedure". This procedure identifies a process by which each Customer is to request, and the Authority is to provide, future water supply from Authority water supply facilities in order to provide the Authority with sufficient lead-time for planning and development of new water supply sources to meet new water supply demands. By no later than January 15th of each Contract year, every Customer submits to the Authority a report which identifies the following:

1. Total projected water demand for the next 20 years;
2. That portion of the projected 20-year demand the Customer requires the Authority to fulfill;
3. The basis for each projection.

The Authority uses this data as a basis for its planning and development of new regional water supply sources to meet new water supply demands. Therefore, these submittals provide the foundation for the Authority to predict regional demands.

This Section identifies 20-year demand projections provided by Authority Customers to the Authority in 2018 for the 2020-2040 planning period. Because some customers only provided projections for the required 20-year period as of 2018 (2019-2038), and the 2020 IRWSP is intended to present demands for 2020-2040, where necessary the Customer 2018 projections were extrapolated through 2040. The projected individual demands for each Customer through 2040 were summed to provide an aggregate projection of regional demands for the region through 2040. These demand projections are collectively referred to herein as "Customer 2018" demand projections.

3.1.1.1 Charlotte County 20-Year Demand Projections

Charlotte County's demand projections were provided to the Authority through correspondence dated January 26, 2018. Previous IRWSPs did not consider service to the Burnt Store area due to its remote location and because there were no plans to interconnect it to the Regional System. However, it is now anticipated that the Burnt Store service area will be interconnected to the Regional System during the 20-year planning period. Therefore, demands for the Burnt Store service area are included in the total projected demands for Charlotte County below.

The projected demands by Charlotte County for the planning period are summarized in Table 3.1. The demands shown for 2039 and 2040 were provided with the County's 2018 demand projection submittal. The County's projections show total water demands increasing at an annualized growth rate of 1.51% from 2019 to 2040, with demands increasing from 15.50 MGD in 2019 to 21.22 MGD by 2040 (increase of 5.72 MGD).

Table 3.1 - Charlotte County Projected Demands 2019-2040

2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
15.50	15.73	16.02	16.31	16.60	16.89	17.18	17.47	17.77	18.06	18.35
2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
18.65	18.91	19.17	19.44	19.70	19.96	20.21	20.47	20.72	20.97	21.22

Note: Demands anticipate service to Burnt Store Service Area

3.1.1.2 DeSoto County 20-Year Demand Projections

DeSoto County's demand projections were provided to the Authority on January 31, 2018. The projected demands for DeSoto County include the County's existing service area as well as future supply to several forthcoming development projects. However, the County has not yet included the planned interconnection of the DeSoto Correctional Institution (DCI) to the Regional System. It is generally anticipated that water supply from the PRF will be used to replace existing DCI water supply facilities by about 2024. Actual use at the DCI facility in recent years has been approximately 0.300 MGD. Therefore, the County's demand projections have been adjusted to include service to the DCI facility at 0.300 MGD beginning in 2024. The demands shown for 2039 and 2040 in the 2018 demand projection (2019-2038) were derived by carrying forward the County's 2038 value due to the County's lower growth rate in the latter part of the 20-year planning period.

The County's projections show water demands increasing at an annualized growth rate of 3.80% from 2019 to 2040, with demands increasing from 0.68 MGD in 2019 to 1.40 by 2040 (increase of 0.72 MGD MGD). Projected demands are summarized in Table 3.2.

Table 3.2 - DeSoto County Demand Projections 2019-2040

2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
0.68	0.74	0.85	0.94	1.01	1.35	1.37	1.38	1.39	1.39	1.39
2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
1.39	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40

Note: Demands anticipate service to Desoto Correctional Institution (DCI)



3.1.1.3 Sarasota County 20-Year Demand Projections

Sarasota County's demand projections were provided to the Authority in March, 2018. The demands shown for 2039 and 2040 were provided with the County's 2018 demand projection submittal.

The County's projections show water demand increasing at annualized growth rate of 1.24% average from 2019-2040, with demands increasing from 22.98 MGD in 2019 to 29.70 MGD by 2040 (6.72 MGD increase). Projected demands for Sarasota County are summarized in Table 3.3.

Table 3.3 - Sarasota County Demand Projections 2019-2040

2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
22.98	23.30	23.62	23.94	24.26	24.58	24.90	25.22	25.54	25.86	26.18
2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
26.50	26.82	27.14	27.46	27.78	28.10	28.42	28.74	29.06	29.38	29.70

3.1.1.4 City of North Port 20-Year Demand Projections

The City of North Port's demand projections were provided to the Authority on December 13, 2017. The demands shown for 2039 and 2040 were derived by extrapolating demands from the City's 2038 value at a quantity of 0.360 MGD/year (the average annual increase over the last five years provided by the City for the 2019-2038 projection period). The City of North Port demand projections show water demand increasing by an annualized growth rate of 5.26%/year, with demand projected to rise from 3.68 MGD in 2019 to 10.76 MGD in 2040 (increase of 7.08 MGD). Projected demands for the City are summarized in Table 3.4.

Table 3.4 - City of North Port Demand Projections 2019-2040

2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
3.68	3.99	4.41	4.82	5.12	5.37	5.64	5.92	6.22	6.53	6.86
2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
7.20	7.56	7.94	7.25	8.58	8.93	9.28	9.65	10.04	10.40	10.76

3.1.1.5 Manatee County 20-Year Demand Projections

Manatee County supplies water to its own retail customers and also currently maintains 10.0 MGD of reserve capacity for its wholesale customers including the Cities of Palmetto (2.0 MGD) and Bradenton (0.500 MGD), Town of Longboat Key (2.50 MGD), and Sarasota County (5.0 MGD). Manatee County demands provided herein exclude the 5.0 MGD of Reserve Capacity for Sarasota

County because these demands are already accounted for in Sarasota County's projections. The demands of the Town of Longboat Key and City of Palmetto are met entirely by Manatee County, while the City of Bradenton meets the majority of its own demands through self-supply.

Manatee County's demand projections were provided to the Authority on January 23, 2018. The demands shown for 2039 and 2040 were extrapolated by increasing demands at same rate as 2037 to 2038 (0.90 MGD/year). Manatee County's projections show demands increasing at annualized growth rate of 1.48%/year, with demand rising from 40.98 MGD in 2019 to 55.75 MGD by 2040 (increase of 14.77 MGD). Projected demands for Manatee County are summarized in Table 3.5.

Table 3.5 - Manatee County Demand Projections 2019-2040

2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
40.98	41.41	41.93	42.46	43.00	43.56	44.12	44.74	45.38	46.02	46.69
2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
47.36	48.12	48.89	49.69	50.51	51.34	52.17	53.05	53.95	54.85	55.75

Note: Sarasota County demands currently met by Manatee County are accounted for within Sarasota County demands (Table 3.3).

3.1.1.6 "Customer 2018" 20-Year Regional Demand Projections

The projected demands of each Customer through 2040 were summed to provide an aggregate projection of regional demands through 2040, collectively referred to herein as "Customer 2018" demands. The sum of these Customer-provided demand projections results in an average annual growth rate of 1.69%/year, with demands increasing from 83.81 MGD in 2019 to 118.83 MGD in 2040 (increase of 35.02 MGD). Total projected regional demands (Customer 2018) are provided in Table 3.6.

Table 3.6 - Customer 2018 Regional Demand Projections 2019-2040

2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
83.81	85.17	86.83	88.46	89.99	91.75	93.21	94.74	96.30	97.86	99.48
2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
101.10	102.81	104.54	106.23	107.97	109.73	111.48	113.30	115.16	117.00	118.83

3.1.2 Actual Regional Water Use (FY2010-FY2018)

Actual regional water use for FY2010-FY2018 was examined to provide insight regarding actual water use trends over recent years for demand projection purposes. Between FY2010 and FY2018 total regional demand (i.e. regional production) grew from a total of 61.41 MGD to 69.58 MGD, an



increase of 8.17 MGD (Source: Authority, 2018). The average annual growth rate for this period was 1.60%/year, a rate similar to the aggregate “Customer 2018” annualized growth rate of 1.69%/year.

A comparison was undertaken of actual FY2018 regional water use (69.58 MGD) vs the “Customer 2018” projected demand for 2019 (83.81 MGD). This comparison determined that “Customer 2018” projected demand for 2019 represents a 14.23 MGD (20.4%) increase in actual regional water use in just one year, a rate that greatly exceeds that expected by Authority Customers and historic actual use growth rates. As a result, two additional methodologies were employed to assist in projecting 20-year demands using a more realistic baseline (starting) condition as described below.

3.1.2.1 “Customer 2018 Adjusted” Demand Projections 2019-2040

The “Customer 2018 Adjusted” methodology utilized FY2018 actual water use (69.58 MGD) in conjunction with the aggregate “Customer 2018” annualized growth rate of 1.69% to project demands. This methodology projects 2019 and 2040 demands of 70.76 MGD and 100.60 MGD, respectively (increase of 29.84 MGD). “Customer 2018 Adjusted” projected demands are provided in Table 3.7.

Table 3.7 - Customer 2018 Adjusted Demand Projections 2019-2040

2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
70.76	71.95	73.17	74.40	75.66	76.94	78.24	79.56	80.91	82.27	83.67
2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
85.08	86.52	87.98	89.47	90.98	92.52	94.08	95.67	97.29	98.93	100.60

3.1.2.2 “Authority Actual Use (FY2010-FY2018)” Demand Projections 2019-2040

The “Authority Actual Use FY2010-FY2018” methodology utilized FY2018 actual water use (69.58 MGD) as the baseline condition in conjunction with annualized actual use growth rate for the FY2010-FY2018 period (1.60%/year). This methodology projects 2019 and 2040 demands of 70.69 MGD and 98.66 MGD, respectively (increase of 27.97 MGD). “Authority Actual Use FY2010-FY2018” projected demands are provided in Table 3.8.

Table 3.8 - Authority Actual Use (FY2010-FY2018) Demand Projections 2019-2040

2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
70.69	71.82	72.97	74.14	75.33	76.53	77.76	79.00	80.27	81.55	82.85
2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
84.18	85.53	86.90	88.29	89.70	91.13	92.59	94.07	95.58	97.11	98.66

3.1.3 BEBR Projections and Methodology

This Section presents countywide permanent population projections from the University of Florida's Bureau of Economic and Business Research (BEBR) for the Authority's Member Governments and Customers. BEBR population estimates are used for multiple planning purposes in Florida. Although BEBR does not project water use demands, their population projections are a key variable in determining such projections. Therefore, the annual growth rates in population are closely tied to annual growth rates for projected water demands.

The BEBR-based demand projection methodologies employed herein utilize BEBR's historical estimates of population growth for the Authority's four-county area (1990-2018) and BEBR's 2018 High and Medium population projections for the 2020-2040 planning period. BEBR's estimated populations for the Authority's four counties were summed to identify an estimated regional population.

As shown in Table 3.9, the annualized growth rate for BEBR-estimated population for the combined four-county region for the last five (2013-2018), ten (2008-2018), twenty (1998-2018), and twenty-five years (1993-2018) have been 2.0%/year, 1.3%/year, 1.9%/year, and 2.1%/year, respectively.



Table 3.9 - BEBR Historical Population Estimates from 1990-2018

Fiscal Year	BEBR-Estimated Population ¹					
	Charlotte County	Manatee County	DeSoto County	Sarasota County	City of North Port	TOTAL REGION
	<i>Persons</i>	<i>Persons</i>	<i>Persons</i>	<i>Persons</i>	<i>Persons</i>	<i>Persons</i>
1990	110,975	211,707	23,865	265,803	11,973	624,323
1991	116,356	215,917	24,973	270,711	12,558	640,515
1992	119,356	220,722	25,561	273,571	13,038	652,248
1993	122,506	225,206	26,234	275,940	13,591	663,477
1994	125,718	230,394	27,015	280,042	14,282	677,451
1995	128,896	235,729	27,820	283,947	15,161	691,553
1996	130,998	240,008	28,336	287,488	15,905	702,735
1997	132,850	245,505	29,087	291,344	16,708	715,494
1998	134,917	250,871	30,128	295,546	17,672	729,134
1999	138,128	257,391	31,169	299,589	18,749	745,026
2000	141,627	264,002	32,209	303,164	22,797	763,799
2001	144,866	270,887	32,592	306,990	25,234	780,569
2002	148,304	278,001	32,697	311,555	27,448	798,005
2003	151,269	285,606	33,449	314,953	31,352	816,629
2004	154,709	294,056	33,870	319,567	35,721	837,923
2005	153,274	303,729	33,364	323,650	41,000	855,017
2006	156,491	312,396	33,666	322,265	47,770	872,588
2007	160,083	317,899	34,170	320,196	53,732	886,080
2008	160,412	319,970	34,459	320,074	56,316	891,231
2009	159,860	321,035	34,709	321,601	55,759	892,964
2010	159,978	322,833	34,862	322,091	57,357	897,121
2011	160,463	325,905	34,708	323,426	57,893	902,395
2012	163,357	330,302	34,408	324,990	58,674	911,731
2013	163,679	333,880	34,367	326,061	59,231	917,218
2014	164,467	339,545	34,426	326,845	60,295	925,578
2015	167,141	349,334	34,777	329,855	62,235	943,342
2016	170,450	357,591	35,141	335,066	64,472	962,720
2017	172,720	368,782	35,621	340,064	67,196	984,383
2018	177,987	377,826	35,520	346,811	70,631	1,008,775
Time Interval	Annualized Growth Rate					
2013-2018	1.7%	2.6%	0.7%	1.3%	3.8%	2.0%
2008-2018	1.1%	1.8%	0.3%	0.8%	2.5%	1.3%
1998-2018	1.6%	2.5%	0.9%	0.9%	15.0%	1.9%
1993-2018	1.8%	2.7%	1.4%	1.0%	16.8%	2.1%

Note:

¹ Countywide population, including municipalities

As shown in Table 3.10, BEBR's 2018 population projections for the Authority's four-county area for 2020-2040 identify annualized growth rates of 1.22%/year and 1.98%/year, respectively, for BEBR's Medium and High population projections.

Table 3.10 - BEBR 2018 Estimated Population and 2020-2040 Projections

Current Population Estimate ²	Population Projections ¹						Change in Population 2020-2040	Annualized Growth Rate 2020-2040
	BEBR	2020	2025	2030	2035	2040		
CHARLOTTE COUNTY								
177,987	Low	169,200	171,200	173,000	174,100	174,200	5,000	0.15%
	Medium	179,300	189,200	197,800	205,700	212,800	33,500	0.93%
	High	189,700	206,200	222,700	239,100	255,500	65,800	1.73%
DESOTO COUNTY								
35,520	Low	34,200	33,900	33,700	33,500	33,200	-1,000	-0.15%
	Medium	35,800	36,700	37,500	38,300	38,900	3,100	0.43%
	High	37,600	39,600	41,700	43,800	45,900	8,300	1.10%
MANATEE COUNTY								
377,826	Low	371,400	392,300	410,100	423,500	431,800	60,400	0.81%
	Medium	394,300	434,700	469,500	500,400	526,800	132,500	1.68%
	High	416,600	471,900	526,800	578,600	625,700	209,100	2.51%
SARASOTA COUNTY								
417,442	Low	406,200	417,700	425,900	430,200	431,500	25,300	0.31%
	Medium	426,300	454,200	475,900	493,900	509,000	82,700	0.97%
	High	446,600	488,100	526,400	561,300	594,700	148,100	1.66%
CHARLOTTE, DESOTO, MANATEE AND SARASOTA COUNTIES								
1,008,775	Low	981,000	1,015,100	1,042,700	1,061,300	1,070,700	89,700	0.46%
	Medium	1,035,700	1,114,800	1,180,700	1,238,300	1,287,500	251,800	1.22%
	High	1,090,500	1,205,800	1,317,600	1,422,800	1,521,800	431,300	1.98%

Notes:

¹ Countywide population, including municipalities

² 2018 population estimate based on April 1, 2018 BEBR Estimated Population

3.1.3.1 BEBR-Estimated Population Growth (1998-2018) Projection

This demand projection methodology applies BEBR's 1.9%/year annualized historical 20-year population growth rate (for 1998-2018) for the Authority's four-county area (Table 3.9) using FY2018 actual use (69.58 MGD) as the baseline for projections. This methodology projects 2019 and 2040 demands of 70.90 MGD and 105.27 MGD, respectively (increase of 34.37 MGD). The projected demands are summarized in Table 3.11.



Table 3.11 - BEBR-Estimated Population Growth (1998-2018) Demands (MGD)

2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
70.90	72.25	73.62	75.02	76.45	77.90	79.38	80.89	82.42	83.99	85.59
2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
87.21	88.87	90.56	92.28	94.03	95.82	97.64	99.49	101.38	103.31	105.27

3.1.3.2 BEBR High Population Projection (2020-2040) Demands

This demand projection methodology applies BEBR's High population projection annualized growth rate for 2020-2040 (1.98%/year) for the Authority's four-county area using FY2018 actual use (69.58 MGD) as the baseline for projections. This methodology projects 2019 and 2040 demands of 70.96 MGD and 107.11 MGD, respectively (increase of 36.15 MGD). The projected demands are summarized in Table 3.12.

Table 3.12 - BEBR High Population Projection (2020-2040) Demands (MGD)

2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
70.96	72.36	73.79	75.25	76.74	78.26	79.82	81.40	83.01	84.66	86.33
2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
88.04	89.78	91.56	93.37	95.22	97.10	99.02	100.98	102.98	105.02	107.11

3.1.3.3 BEBR Medium Population Projection (2020-2040) Demands

This demand projection methodology applies BEBR's Medium population projection annualized growth rate for 2020-2040 (1.22%/year) for the Authority's four-county area using FY2018 actual use (69.58 MGD) as the baseline for projections. This methodology projects 2019 and 2040 demands of 70.43 MGD and 90.85 MGD, respectively (increase of 20.42 MGD). The projected demands are summarized in Table 3.13.

Table 3.13 - BEBR Medium Population Projection (2020-2040) Demands (MGD)

2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
70.43	71.29	72.16	73.04	73.93	74.83	75.74	76.66	77.60	78.50	79.50
2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
80.48	81.46	82.46	83.46	84.48	85.51	86.55	87.61	88.68	89.76	90.85

3.1.4 SWFWMD Draft Regional Water Supply Plan (RWSP) 2020

The SWFWMD uses a variety of data and information sources to project public supply demands, including but not limited to the SWFWMD's Estimated Water Use (EWU) reports; Public Supply Annual Reports (PSARs) submitted by Water Use Permit (WUP) Permittees; University of Florida's BEBR publications; the SWFWMD's Geographic Information System (GIS) model; and other data gathered from stakeholders, which enables the SWFWMD to project population at the utility service area level.

The SWFWMD's Draft 2020 RWSP Population and Demand Projections (June 14, 2018) document provides a detailed description of the SWFWMD's methodology employed in projecting Public Supply demand projections. The SWFWMD's latest 20-year demand projections for Authority Members and Customers were derived from the same document. The SWFWMD's methodology projects 2020 and 2040 demands of 69.62 MGD and 87.24 MGD respectively, which represents an increase of 17.62 MGD over the 20-year planning period. The SWFWMD's projected demands are provided in Table 3.14.

Table 3.14 - SWFWMD Projected Demands (MGD)

2020	2025	2030	2035	2040
69.62	75.00	79.67	83.78	87.24

The SWFWMD's latest 20-year demand projections for other regional non-members were also derived from the SWFWMD's Draft 2020 RWSP Population and Demand Projections. It should be noted that projections of individual non-members may not be the same as those developed by the SWFWMD. The eight non-member local governments within the Authority's four-county region that comprise the other Regional Water include:

- City of Punta Gorda
- City of Arcadia
- City of Bradenton
- Town of Longboat Key
- City of Palmetto
- City of Sarasota
- City of Venice
- Englewood Water District



The SWFWMD’s methodology projects 2020 and 2040 demands of 25.30 MGD and 27.22 MGD, respectively, which represents an increase of 1.92 MGD over the 20-year planning period. The SWFWMD’s projected demands are provided in Table 3.15.

Table 3.15 - SWFWMD Projected Demands for Other Non-Members (MGD)

2020	2025	2030	2035	2040
25.30	26.01	26.56	26.93	27.22

3.1.5 Most Probable Demand Projection

The results of the seven demand projection methodologies presented above are compiled in Table 3.16.

Table 3.16 - Compilation of Regional Demand Projection – Various Methodologies

Method	Source	Annualized Growth Rate	2020	2025	2030	2035	2040
		(%)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)
1	SWFWMD Draft 2020 RWSP	1.27	69.62	75	79.67	83.78	87.24
2	Customer 2018	1.69	85.17	93.21	101.1	109.73	118.83
3	Customer 2018 Adjusted	1.69	71.95	78.24	85.08	92.52	100.6
4	Authority Actual Use	1.6	71.82	77.76	84.18	91.13	98.66
5	BEBR High Projection	1.98	72.36	79.82	88.04	97.1	107.11
6	BEBR Med Projection	1.22	71.29	75.74	80.48	85.51	90.85
7	BEBR-Population Last 20 Years	1.9	72.25	79.38	87.21	95.82	105.27

The 2040 demands projected by Methods 1-7 range from a low of 87.24 MGD (SWFWMD 2018) to a high of 118.83 MGD (Customer 2018), which represents a range of 31.59 MGD. Technical Memorandum 5A of the 2015 IRWSP recommended disregarding the highest and lowest of the seven methodologies to identify a “Most Probable Range of Demands” and that recommended approach was undertaken for the 2020 IRWSP.

With removal of the highest (Customer 2018) and lowest projections (SWFWMD 2018), the BEBR High and BEBR Medium projections constitute the High and Low end of the Most Probable Range of Demands. A median projection was generated from these values and is recommended as the “Most

Probable Demand Projection” for the 20-year planning period. The resulting median annual growth rate is 1.60%, a value identical to the annualized actual use growth rate for the region in FY2010-FY2018. The recommended Most Probable Demand Projection is identified as the “Median Projection” in Table 3.17.

Table 3.17 - Most Probable Range of Demands for 2020 IRWSP

	Annualized Growth Rate	2020	2025	2030	2035	2040
Source	(%)	(MGD)	(MGD)	(MGD)	(MGD)	(MGD)
High Projection	1.98	72.36	79.82	88.04	97.1	107.11
Median Projection	1.60	71.83	77.76	84.19	91.14	98.67
Low Projection	1.22	71.29	75.74	80.48	85.51	90.85

3.1.6 Projected Total Finished Water Requirements

In addition to planning to meet projected demands, the Authority has adopted Best Management Practices (BMPs) which include maintenance of a 6% Rotational Reserve Capacity and compliance with a 90% Capacity Standard. The 6% Rotational Reserve Capacity concept was included in the Authority's 2006 IRWSP, was maintained as a BMP in the 2015 IRWSP, and is again recommended in this 2020 IRWSP Update. The 6% Rotational Reserve Capacity is added to projected demands to identify “total projected demands.” The 6% Rotational Reserve Capacity is an appropriate BMP because unforeseen circumstances can develop that require immediate access to additional capacity such as: severe droughts, mechanical disruptions in existing water supply facilities, and storm events, such as hurricanes, which may disrupt facility operations and also the potential for impairment/contamination of sources. Reserve Capacity not only provides insurance against the risk of unfortunate happenstances such as those described above but also provides flexibility for covering the needs exerted by temporal bursts of development within the Region and enables elected officials to more effectively participate in unforeseen economic development opportunities that may require significant additional quantities of water on short notice.

The 90% Capacity Standard calls for new water supply capacity to be completed and online prior to total projected demands (i.e. projected demands + 6% Rotational Reserve) exceeding 90% of the prevailing available annual average finished water supply capacity. The 90% Capacity Standard BMP provides a safety factor to ensure there is always sufficient average day production capacity available considering that it typically takes five or more years to develop a new water supply source.



The 6% Rotational Reserve and 90% Capacity Standard are collectively referred to herein as a “17% Capacity Standard” because their combined application to projected demands results in a required “total finished water capacity” that is approximately 17% (16.597%) above projected demands. The 17% Capacity Standard BMP ensures that the region has a reliable and adequate supply capacity for future growth and unexpected events.

The 17% Capacity Standard was applied to the Most Probable Demand Projection (i.e. the Median Projection identified in Table 3.17) to identify the total finished water capacity required to comply with the Authority’s 17% Capacity BMP standard through 2040. The total finished water capacity required to meet the “Most Probable Demand” projection scenario is identified in Table 3.18. As shown, the total finished capacity required for 2040 is 115.04 MGD.

Table 3.18 - Total Finished Capacity Required for Most Probable Demands

Year	Projected Demand (MGD)	17% Capacity Standard (MGD)	Total Finished Capacity Required (MGD)
2020	71.83	11.92	83.75
2021	72.98	12.11	85.09
2022	74.15	12.31	86.45
2023	75.33	12.50	87.84
2024	76.54	12.70	89.24
2025	77.76	12.91	90.67
2026	79.01	13.11	92.12
2027	80.27	13.32	93.59
2028	81.56	13.54	95.09
2029	82.86	13.75	96.61
2030	84.19	13.97	98.16
2031	85.53	14.20	99.73
2032	86.90	14.42	101.33
2033	88.29	14.65	102.95
2034	89.71	14.89	104.59
2035	91.14	15.13	106.27
2036	92.60	15.37	107.97
2037	94.08	15.61	109.69
2038	95.59	15.86	111.45
2039	97.12	16.12	113.23
2040	98.67	16.38	115.04
Total Increase (2020-2040)	26.84	4.46	31.29

3.2 50-Year Demand Projections

This Section first provides demand projections for the 50-year period of 2020-2070 for Authority Members and Customers followed by projections for non-members within the Authority's four-county region who are not Authority Members or Customers.

3.2.1 50-Year Demand Projections for Authority Members and Customers

The Most Probable Range of Demands identified in Table 3.17 for 2020-2040 were extrapolated at their respective growth rates to identify High, Low, and Median projected demands through 2070. These 50-year projections are discussed in Sections 3.2.1.1 - 3.2.1.3 below.

3.2.1.1 Most Probable Range – High Projection (BEBR High)

This method adopts the 20-year “High Projection” identified in Table 3.17 for 2020-2040 and projects demands for 2041-2070 at the BEBR High population projection annualized growth rate of 1.98%/year. This methodology projects 2020 and 2070 demands of 72.36 MGD and 192.86 MGD, respectively (increase of 120.50 MGD). These 50-year demand projections are provided in Table 3.19.

Table 3.19 - 50-Year Demand Projections - High Projection (BEBR High) (MGD)

2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
72.36	73.79	75.25	76.74	78.26	79.81	81.39	83.00	84.65	86.32
2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
88.03	89.78	91.55	93.37	95.22	97.10	99.02	100.98	102.98	105.02
2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
107.10	109.22	111.39	113.59	115.84	118.13	120.47	122.86	125.29	127.77
2050	2051	2052	2053	2054	2055	2056	2057	2058	2059
130.30	132.88	135.51	138.20	140.93	143.72	146.57	149.47	152.43	155.45
2060	2061	2062	2063	2064	2065	2066	2067	2068	2069
158.53	161.66	164.87	168.13	171.46	174.85	178.32	181.85	185.45	189.12
2070	Total Increase (2020-2070)								
192.86	120.50								



3.2.1.2 Most Probable Range – Low Projection (BEBR Medium)

This method adopts the 20-year “Low Projection” identified in Table 3.17 for 2020-2040 and projects demands for 2041-2070 at the BEBR Medium population projection annualized growth rate of 1.22%/year. This methodology projects 2020 and 2070 demands of 71.29 MGD and 130.72 MGD, respectively (increase of 59.43 MGD). These 50-year demand projections are provided in Table 3.20.

Table 3.20 - 50-Year Demand Projections - Low Projection (BEBR Medium) (MGD)

2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
71.29	72.16	73.04	73.93	74.83	75.75	76.67	77.61	78.55	79.51
2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
80.48	81.46	82.46	83.46	84.48	85.51	86.55	87.61	88.68	89.76
2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
90.86	91.96	93.09	94.22	95.37	96.54	97.71	98.91	100.11	101.33
2050	2051	2052	2053	2054	2055	2056	2057	2058	2059
102.57	103.82	105.09	106.37	107.67	108.98	110.31	111.66	113.02	114.40
2060	2061	2062	2063	2064	2065	2066	2067	2068	2069
115.79	117.21	118.64	120.08	121.55	123.03	124.53	126.05	127.59	129.15
2070	<i>Total Increase (2020-2070)</i>								
130.72	59.43								

3.2.1.3 Most Probable Demand – Median Projection

This method adopts the 20-year “Median Projection” identified in Table 3.17 for 2020-2040 and projects demands for 2041-2070 at the median population projection annualized growth rate of 1.60%/year. This methodology projects 2020 and 2070 demands of 71.83 MGD and 158.85 MGD, respectively (increase of 87.02 MGD). These 50-year demand projections are considered to be the “Most Probable Demand” scenario and are provided in Table 3.21.

Table 3.21 - 50-Year Demand Projections – Median Projection (MGD)

2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
71.83	72.98	74.15	75.33	76.54	77.76	79.01	80.27	81.56	82.86
2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
84.19	85.53	86.90	88.29	89.71	91.14	92.60	94.08	95.59	97.12
2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
98.67	100.25	101.85	103.48	105.14	106.82	108.53	110.26	112.03	113.82
2050	2051	2052	2053	2054	2055	2056	2057	2058	2059
115.64	117.49	119.37	121.28	123.22	125.19	127.20	129.23	131.30	133.40
2060	2061	2062	2063	2064	2065	2066	2067	2068	2069
135.54	137.70	139.91	142.15	144.42	146.73	149.08	151.46	153.89	156.35
2070	Total Increase (2020-2070)								
158.85	87.02								

3.2.2 Finished Water Capacity Required

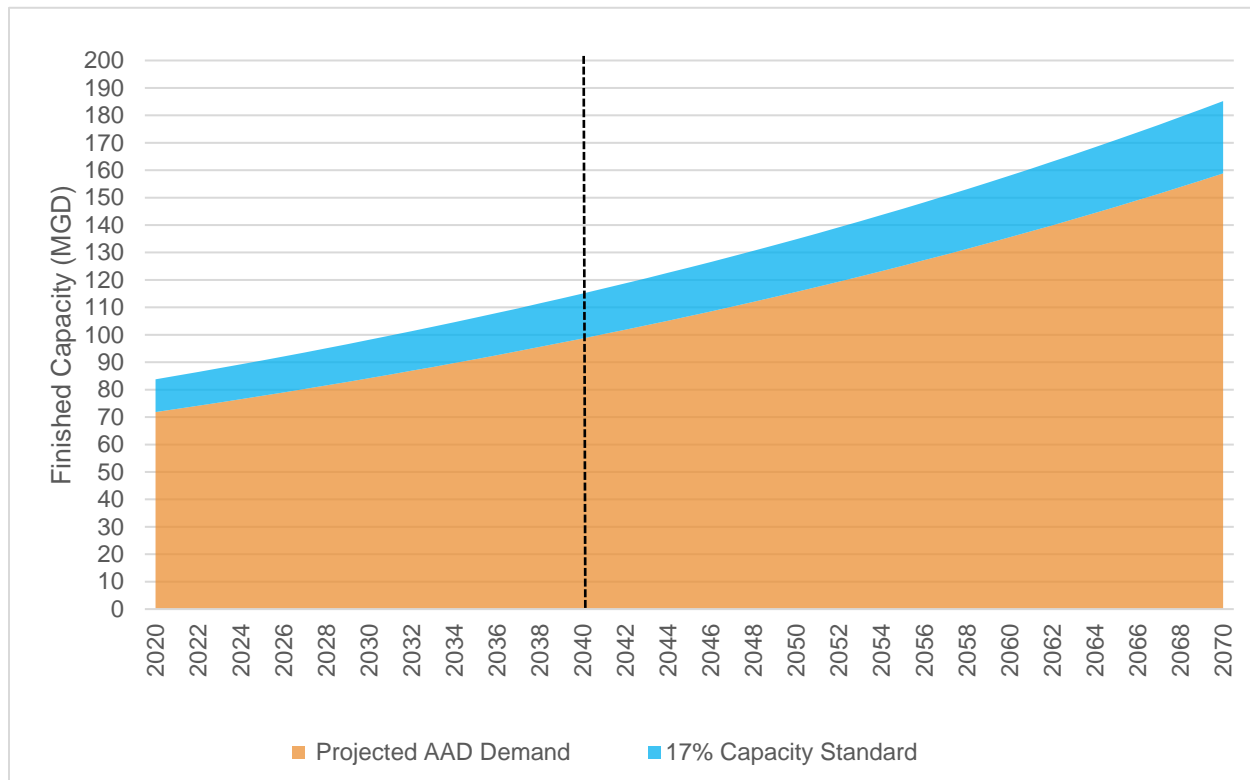
The 17% Capacity Standard was applied to the Most Probable 50-year Demand projections (i.e. Median Projection) provided in Table 3.21 to identify the total finished water capacity that would be required through 2070. The total finished water capacity for this scenario is provided in Table 3.22. As shown, the total finished water capacity required in 2070 is 185.22 MGD.



Table 3.22 - Total Finished Capacity Required for Most Probable Demand Scenario (MGD)

2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
83.75	85.09	86.46	87.84	89.24	90.67	92.12	93.60	95.09	96.62
2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
98.16	99.73	101.33	102.95	104.60	106.27	107.97	109.70	111.45	113.24
2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
115.05	116.89	118.76	120.66	122.59	124.55	126.54	128.57	130.63	132.72
2050	2051	2052	2053	2054	2055	2056	2057	2058	2059
134.84	137.00	139.19	141.42	143.68	145.98	148.31	150.69	153.10	155.55
2060	2061	2062	2063	2064	2065	2066	2067	2068	2069
158.03	160.56	163.13	165.74	168.39	171.09	173.83	176.61	179.43	182.30
2070	Total Increase (2020-2070)								
185.22	101.47								

Figure 3.2 - Total Finished Capacity Required for Most Probable Demand Scenario



3.2.3 50-Year Demand Projections for Other Non-Members

The SWFWMD's latest 20-year demand projections for other regional non-members presented in Section 3.1.4 (SWFWMD Draft RWSP 2020) served as the foundation for the 50-year demand projections for these non-members. The 50-year projections for each of the other non-members were extrapolated from their respective SWFWMD 2040 demand projections using their respective annualized growth rates to project demands for 2041-2070 for each non-member. These individual demands were then summed to identify the aggregate total demand projections for the other regional non-members. Again, it should be noted that projections of individual non-members may not be the same as those developed by the SWFWMD. Projections do not account for potential build-out limitations.

The aggregate 50-year demand projections for other regional non-members are provided in Table 3.23. As shown, total other non-member demands are projected to increase from 25.30 MGD in 2020 to 30.80 by 2070 (increase of 5.50 MGD).

Table 3.23 - 50-Year Demand Projections for Other Non-Members (MGD)

2020	2030	2040	2050	2060	2070
25.30	26.57	27.22	28.33	29.53	30.80

3.3 Peak Month and Maximum Day Factor Analysis

The Authority's 2005 MWSC allocates quantities from the PRF to its Customers. The Second Amendment to the Authority's MWSC, which was entered into in August of 2015, specifies Annual Average Daily Flows (AADF), Peak Month (PM), and Maximum Day (MD) quantity allocations for each Customer. These flow rate comparisons are important because they form the foundation of regulatory permits, treatment, storage and pumping facility design criteria and also transmission system design. However, the factors may change with time as systems grow and become more diversified. This report section re-evaluates peaking factors used for contract deliveries for finished water pumped from the PRF into the regional distribution system based on the Authority's monthly operating reports from January 2008 through December 2018 in order to observe demand patterns and recommend revisions to the peaking factors where appropriate.

The Regional Expansion Program, which was completed in 2009, increased the Authority's permitted river intake capacity from 90 MGD to 120 MGD, increased their water treatment capacity from 24 MGD to 48 MGD, and increased raw water storage capacity from 0.6 BG to 6.5 BG. In 2015,

the Authority completed the “1991 Rebuild Project” which, among other improvements, increased water treatment capacity to 51 MGD. Associated increases in water allocations after completion of the Regional Expanse Program and 1991 Rebuild Project are apparent. The historic and current total AADF, PM, and MD quantity allocations in the Second Amendment are summarized in Table 3.24 along with the corresponding annual PM Peaking Factor taken as the ratio of PM to AADF and the corresponding annual MD Peaking Factor taken as the ratio of MD to AADF. It is noted that no New Water Supply Demands were included in the Second Amendment for customers between years 2015 through 2022.

Table 3.24 - Current Contracted Water Allocations

Year	Total Annual Average Daily Flows (AADF) (MGD)	Total Peak Month (PM) (MGD)	Total Maximum Day (MD) (MGD)	PM/AADF	MD/AADF
2008	18.000	23.316	27.311	1.30	1.52
2009 ⁽¹⁾	23.001	27.954	33.594	1.22	1.46
2010	28.000	33.183	39.874	1.19	1.42
2011	32.700	38.096	45.780	1.17	1.40
2012	32.700	38.096	45.780	1.17	1.40
2013	32.700	38.096	45.780	1.17	1.40
2014	32.700	38.096	45.780	1.17	1.40
2015	32.700	38.096	45.780	1.17	1.40
2016 ⁽²⁾	34.700	41.652	48.580	1.20	1.40
Remaining Years ⁽³⁾	34.700	41.652	48.580	1.20	1.40

Notes:

⁽¹⁾ Begin increased allocation from Regional Expansion Program.

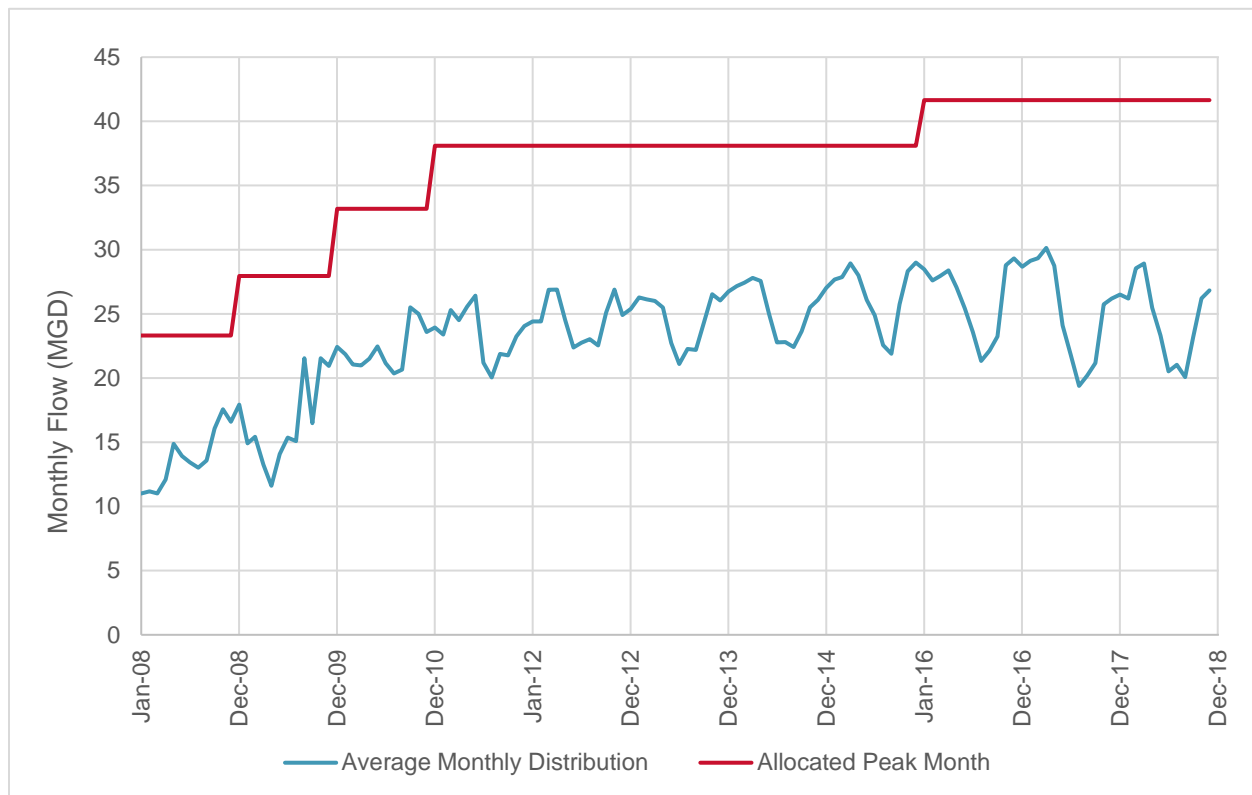
⁽²⁾ Begin increased allocation from 1991 Rebuild Project.

⁽³⁾ Remaining years means the remaining term of the current MWSC

In tandem with the Regional Expansion Program being completed, the PM Peaking Factor decreased from 1.30 to 1.17 and was increased in 2016 to 1.20. Likewise, the allocated MD Peaking Factor decreased from 1.52 in 2008 to 1.40 in 2011. Since 2011, the allocated MD Peaking Factor of 1.40 has been unchanged.

For comparison of allocated water to actual customer demand, Figure 3.3 shows the trends of the Average Monthly Flows over the ten year span.

Figure 3.3 - Average Monthly Flows (MGD) 2008 – 2018



Prior to the Regional Expansion Program that was completed in 2009, average monthly flows during 2008 ranged between 11.0 MGD and 17.9 MGD. During 2009, average monthly flows ranged from 11.6 MGD to 21.5 MGD. After 2009, average monthly flows never fell below 19.4 MGD. Each year between 2010 and 2017, the peak monthly flows increased from 25.5 MGD to 30.1 MGD. Average monthly flows during 2018 were observed to be similar to 2017.

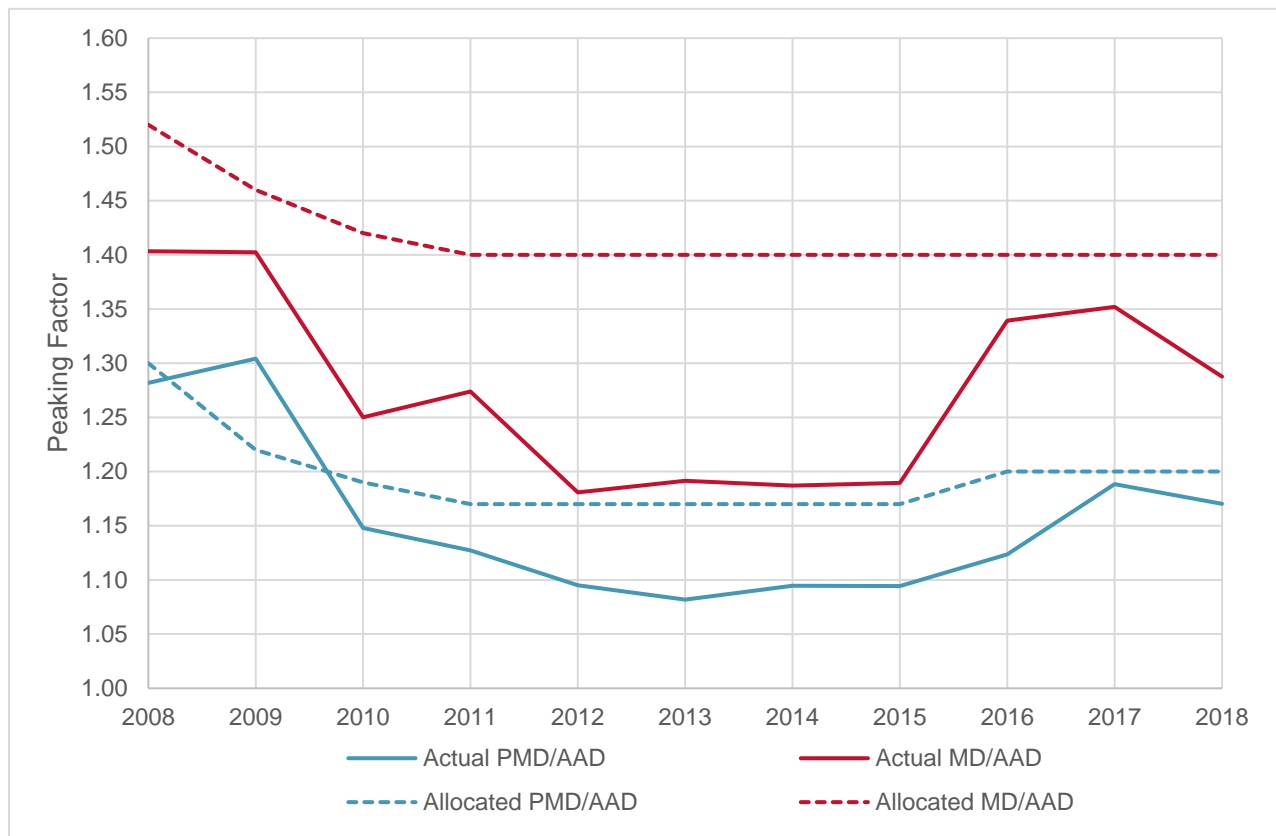
Table 3.25 shows the AADF, PM, and MD for the years 2008 to 2018 for the distribution of finished water from the PRF.

Table 3.25 - Distributed Finished Water from the PRF

Year	Annual Average Daily Flows (AADF) (MGD)	Peak Month (PM) (MGD)	Maximum Day (MD) (MGD)	PM/AADF	MD/AADF
2008	13.70	17.57	19.23	1.28	1.40
2009	16.52	21.54	23.16	1.30	1.40
2010	22.22	25.51	27.78	1.15	1.25
2011	23.44	26.42	29.86	1.13	1.27
2012	24.56	26.89	29.00	1.10	1.18
2013	24.53	26.54	29.23	1.08	1.19
2014	25.40	27.80	30.15	1.09	1.19
2015	26.49	28.99	31.52	1.09	1.19
2016	26.10	29.33	34.96	1.12	1.34
2017	25.36	30.14	34.29	1.19	1.35
2018	24.72	28.93	31.83	1.17	1.29

In comparing the allocated quantities found in Table 3.24 and the actual distributed water in Table 3.25, the allocated quantities have always been greater than the actual distributed water. Figure 3.4 shows the historic PM Peaking Factor and MD Peaking Factors found in Table 3.25 above.

Figure 3.4 - Peaking Factor Trends 2008 – 2018



Although the allocated quantities have historically been sufficient for customer demands of finished water from the PRF, the actual PM/AADF was exceeded in 2009. After 2009 and the completed Regional Expansion Program, the actual PM/AADF has ranged from 1.08 to 1.19. Because the Authority's supply, treatment, and distribution infrastructure have not significantly changed since 2009, trending of the actual PM/AADF does not indicate a need to change the allocated PM/AADF of 1.20 at this time.

The allocated MD/AADF has exceeded the actual MD/AADF since 2008. Actual MD/AADF was 1.4 in 2008 and 2009 while the Regional Expansion Program was completed. Between 2010 and 2015, the actual MD/AADF ranged between 1.18 and 1.27. Between 2016 and 2018, the actual MD/AADF increased to between 1.29 and 1.35. Many factors could affect the behavior of maximum daily flow distribution from year to year, such as customer treatment facilities going offline for repair, customer water supplies becoming unavailable, and customer preference of Authority water consumption over consumption of their own water supplies. Because many factors can affect the swing of maximum daily flow distribution between years, it is not recommended that the allocated MD/AADF of 1.40 is modified at this time.

4 Regional Available Sources and Resiliency

The Authority's four county region relies on a robust water supply portfolio, including surface water and groundwater, to treat and provide water to the public water system customers. The Peace River provides fresh surface water for the Authority to store in its reservoirs prior to treatment and subsequent storage in ASR for future treatment and/or wholesale transmission to its five municipal customers. However, as potable water demand grows in the region, the Authority will need new source water alternatives to meet the growing water demands. This section discusses the regional sources identified in the 2015 Plan, the regional action taken to develop these sources, the projects identified in the Authority's current CIP, and potential new sources available to meet future regional demands of 16 MGD AAD by 2040 and 86 MGD AAD by 2070 as identified in Section 3.0 of this report.

4.1 Identified Regional Sources

The 2015 Plan analyzed various sources that could be developed by the Authority or other regional municipalities to increase potable water supply in the Authority's four county region. The 2015 Plan culminated numerous investigations conducted between 2007 and 2014 by the Authority, its customers, its partners, and SWFWMD and pinpointed 12 potential future sources listed below:

Groundwater Sources

- Peace River Facility Wellfield
- Punta Gorda Wellfield
- Buffalo Creek Wellfield in Manatee County
- DeSoto County DCI Wellfield
- West Villages Wellfield in the City of North Port

Surface Water Sources

- Cow Pen Slough
- Shell and Prairie Creeks
- Upper Myakka River
- Peace River
- Blackburn Canal

Seawater Desalination Facilities

- Port Manatee
- Near Venice Airport



Since 2015, some of these sources have begun development, either through additional planning efforts, pilot studies, or partial construction. Additional analyses have taken place on the inventory and development of water sources in the region which include the following documents:

- 2015 SWFWMD Regional Water Supply Plan – Southern Planning Region
- 2015 City of Punta Gorda Water Supply Study
- 2016 Flatford Swamp Conceptual Design Evaluation
- 2017 Englewood Water District Utility Master Plan
- 2017 Manatee Water Supply Facilities Work Plan
- 2017 Peace River Facility ASR System Annual Report
- 2018 Peace River One Water Initiative Phase I Inventory and Compilation
- 2019 Authority PRF 50-Year WUP Renewal

Figure 4.1 below outlines this 2020 Plan's identified potential water supply sources, and Table 4.1 below outlines this 2020 Plan's identified potential water supply development projects along with the proposed finished water yield, responsible municipality, the concept as compared to the 2015 Plan, and a status of action taken from the Authority or regional municipalities to develop that source or project.

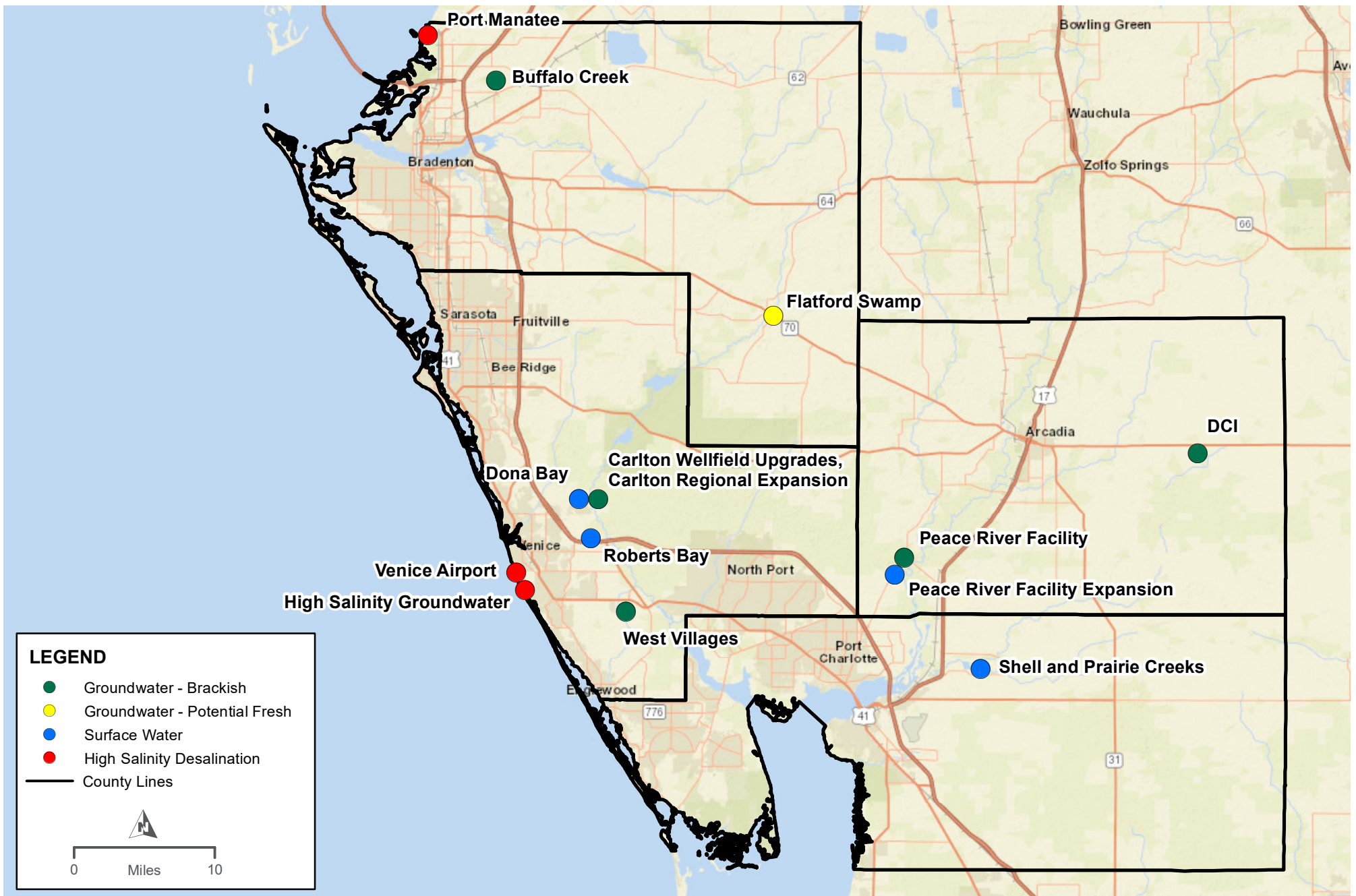




Table 4.1 - Potential Regional Source Projects and Actions Taken

Potential Source/Project	Yield (MGD)	Responsible Municipality	Concept vs. 2015 Plan	Status
Punta Gorda Brackish Wellfield	4	Punta Gorda	Previous Plan	In construction, to be completed in 2020
West Villages Brackish Wellfield	2	North Port	Previous Plan	In design, to be online by 2022
Peace River Facility Raw Water ASR	0	Authority	New/In CIP	Permit Application submitted. Scheduled to be completed by 2023.
Peace River Facility Phase II Capacity Increase and ASR Wellfield Expansion	4.5	Authority	Carried Forward/In CIP	Scheduled to be completed by 2027
Peace River Facility Surface Water System Expansion	15	Authority	Carried Forward/In CIP	WUP issued 2019. Scheduled to be completed by 2031
Peace River Facility Brackish Wellfield	5.5	Authority	Carried Forward/In CIP	Scheduled to be completed by 2038
Manatee County Buffalo Creek Brackish Wellfield	3	Manatee County	Carried Forward/In CIP	In Source Projections, to be completed by 2033
Cow Pen Slough Surface Water Facility Phase 1	5	Sarasota County	Modified	Partly complete ¹
Cow Pen Slough Surface Water Facility Expansion	10	Sarasota County	Carried Forward	Conceptual
DeSoto Brackish Wellfield Near DCI	5	Authority TBD	Carried Forward	No further action
Shell and Prairie Creeks Surface Water Facility	20	Authority TBD	Carried Forward	No further action
Blackburn Canal Surface Water System	5	Authority TBD	Carried Forward	No further action
Seawater Desalination Facility Near Port Manatee	20	Authority TBD	Carried Forward	No further action
Seawater Desalination Facility Near Venice Airport	20	Authority TBD	Carried Forward	No further action
Flatford Swamp Groundwater Recovery Concept	10	Authority TBD	New Concept	SWFWMD Recharge Pilot ²
Planned Carlton Wellfield Upgrades	7.5	Sarasota County	New Concept	In planning based on customer demand growth
Carlton Regional Expansion Concept	4	Authority	New Concept	Initial groundwater modeling performed
High Salinity Groundwater Desalination Concept	5	Authority	New Concept	No development yet
Partially Treated Water Aquifer Recharge Concept	N/A	Authority	New Concept	Initiated in Peace River ASR Annual Report

Note:

(1) Sarasota County has substantially completed the conveyance improvements to divert flows from Cow Pen Slough to wet detention area in conjunction with a water quality improvement program for Dona Bay. The Surface Water Storage Facility is being designed, and construction is projected to be complete in 2023. Development of a water treatment facility of this storage facility is not yet scheduled.

(2) SWFWMD is completing an aquifer recharge pilot study at Flatford Swamp. Full implementation of aquifer recharge for all excess Upper Myakka flows could eliminate the possibility of this surface water yield to be developed into a drinking water supply. A separate project is proposed as part of this IRWSP in Section 4.2.4 below.

The projects listed in the table above are discussed in more detail in the subsections to follow. In addition to these discrete projects, additional concepts are discussed for considerations of reclaimed water as an alternative water supply source along with permitting strategies for regional water management.

4.1.1 Cost Comparison

To determine planning level costs for each alternative water source development project, the following methodologies have been considered during analysis to evaluate costs:

- Debt service for all projects is calculated based on a 30 year design life at an annual interest rate of 5%.
- Facility capacity for unit cost evaluation is based on the finished water production capacity of the facility.
- To evaluate unit costs for each project, empirical cost methodologies (US DOI/BOR, 2017) have been used in conjunction with facility cost capacity curves for RO treatment facilities (Voutchkov, 2019; WaterReuse, 2012), conventional water treatment facilities (McGivney and Kawamura, 2008), and reservoirs (SWFWMD, 2017)
- Well construction costs for production wells, disposal wells, and monitoring wells have been provided based on 2019 market trends.
- Capital costs included in this report are based on the 2019 value of the U.S. Dollar.
- Capital O&M costs included in this report are also based on the 2019 value of the U.S. Dollar.
- As needed, capital costs and unit costs for projects from previous years with no additional concept development have been escalated using the Engineering News-Record (ENR, 2019) and RSMeans Historical Construction cost indices (RSMeans, 2019).
- Non-Construction Capital Costs (NCCC) have been developed using historical project data and cost capacity curves. For new projects and projects with limited information, an assumed rate of 15% of the total construction cost has been included for engineering, permitting, and construction management/oversight based on 2019 market trends.
- A 30% contingency has been added to the total capital costs for construction and NCCC for each project to account for any undeveloped plans or considerations.
- Typical O&M costs for reservoirs, wells, water treatment components, pump stations and pipelines were established at a variable rate of 1.5%, 4%, 10%, 10%, and 1%, respectively of

the total construction cost for each component. These cost percentages are assumed based on historical cost rates for similar planning level costs over the total construction cost for each component.

- All costs provided are Class IV planning level cost estimates per AACE International standards.

4.2 Current Water Sources in Construction

4.2.1 Punta Gorda Brackish Wellfield

Since the City of Punta Gorda completed its 2009 Water Supply Master Plan, it has made progress in developing a brackish groundwater supply and RO WTP for conjunctive use with the City's Shell Creek WTP. The finished water from this RO Facility will be blended with finished water from the City's Shell Creek Water Treatment Plant which does not have a salt removal mechanism. This blending aims to increase reliability in providing a consistent high quality drinking water that meets primary and secondary drinking water standards. As indicated in the Authority's 2015 Plan, the original treatment capacity of the system in 2009 was anticipated to be 3 MGD with future potential expansion up to 8 MGD. In 2012, the City pursued a 4 MGD maximum finished water capacity for a total construction cost of \$32.2M. Per the City's CIP, the City has completed the following:

- 6 production wells yielding 5 MGD
- 5 MGD treatment capacity RO Facility with a 20% treatment loss, yielding up to 4 MGD finished water capacity
- 2 concentrate disposal injection wells

The RO WTP is scheduled to be online in May 2020. The total construction cost is expected to be \$40.4M. In addition to this RO WTP and to further enhance reliability, the Authority is constructing the Phase I Transmission Main which will connect to the finished water blending basin, allowing the Authority to provide fresh water to this basin, as well as receive finished water from the Shell Creek Facility. This will also aid in the Shell Creek Facility being able to provide for their exports appropriated in the Authority's OFWUP long term. Both of these projects are anticipated to become part of the Lower Shell Creek Recovery Strategy, which is scheduled to be finalized in 2020.

4.2.2 West Villages Brackish Wellfield

As discussed in Section 2.1.6 of this report, the City of North Port is utilizing a brackish groundwater wellfield to supply a Southwest Water Treatment Plant which will serve the West Villages Improvement District. The groundwater wellfield is permitted for an average and peak withdrawal rate of 2.7 MGD. The City has stipulated in their CIP that the developer for the West Villages Improvement District is required to design, permit, construct, and dedicate to the City the completed

water treatment plant. Construction is expected to be complete in 2022. Per SWFWMD's 2020 Regional Water Supply Plan, the budgetary estimate of construction cost obtained from the developer is \$26.0M. Assuming 25% treatment losses in the RO facility, the finished water capacity is anticipated to be 2.025 MGD.

4.3 Current Water Sources in Capital Improvement Plans

4.3.1 Peace River Withdrawal Upgrades

The Authority's current withdrawals stem from the Peace River and its upstream tributaries. Upstream of the PRF is approximately 1,800 square miles of contributing watershed. In 2010, SWFWMD implemented Minimum Flows and Levels (MFL) for the lower segment of the Peace River as well as Shell Creek, in order to preserve the hydrology and ecology of the area. In 2011, the Authority's WUP was modified to include a diversion schedule from the river consistent with the MFL and allowing up to 120 MGD maximum withdrawal. The Authority's current 50-year WUP was issued on February 26, 2019. The WUP allows the Authority to divert surface water from the Peace River as outlined in a withdrawal schedule set by SWFWMD. This withdrawal schedule is as follows:

Based on the previous day's combined average daily flow as measured at the Arcadia Station, Joshua Creek at Nocatee, and Horse Creek near Arcadia:

- Less than 130 cubic feet per second (cfs): No diversion may occur.
- Between 130 cfs and 624 cfs: The amount of diversion shall not exceed 16% of the previous day's combined average daily flow rate. The diversion quantity shall not exceed the difference between 130 cfs and the previous day's combined average daily flow rate.
- At least 625 cfs: Applies to June 26 through April 19 only. The amount of diversion shall not exceed 28% of the previous day's combined average daily flow rate. The diversion quantity shall not exceed 400 cfs (or 258 MGD).

The quantities withdrawn by the Authority from the Peace River are limited by adopted MFL for the Lower Peace River, the diversion schedule above, existing storage capacity, and the maximum day withdrawal quantity. In addition, there is a special condition in the WUP that could reduce the maximum day withdrawal quantity by up to 48 MGD (from 258 MGD to no lower than 210 MGD). This reduction is to be credited against impact, if any, as determined by SWFWMD for either: 1) development of natural system restoration and potable water supply from Peace Creek or 2) development of withdrawal from the Upper Peace River for reservoir storage or other consumptive uses by the Polk Regional Water Cooperative (PRWC). The maximum day withdrawal quantity reduction specified by SWFWMD shall trigger the Authority to submit a letter modification of their



WUP, and the modification will take effect immediately upon the PRWC providing notification that actual withdraws from Peace Creek or the Upper Peace River are taking place by the PRWC. This special condition will expire if the PRWC does not receive a notice of intent to issue a WUP for withdraws from Peace Creek or the Upper Peace River by February 26, 2029, which is 10 years from the Authority's current WUP issue date.

In the Authority's previous WUP, the withdrawal conditions were the same except the maximum withdrawal rate was limited to 120 MGD. This 138 MGD increase in withdrawal rate allows the Authority to increase their river intake pumping capacity, off-stream reservoir and ASR storage capacity, and water treatment capacity to meet growing regional demands. The Authority has included a series of projects in their CIP to increase their utilization of the Peace River.

The Authority's current 5-Year Capital Improvements Program (CIP) and 20-Year Capital Needs Assessment include the projects listed in Table 4.2. These sources would provide an additional 24.5 MGD yield, with a 4.5 MGD project being initiated in the 5-year planning horizon, and the remaining 20 MGD being listed in the 20-year planning horizon. For consistency in water supply types with the rest of the section, the Peace River RO Facility and Brackish Wellfield project is discussed in Section 4.3.1.4.

Table 4.2 - 2020 Current Authority CIP Sources

2020 Current PRMWRSA CIP Sources	Yield (MGD)	Scheduled Start	Scheduled Completion
Peace River Facility Raw Water ASR	0	2020	2022
Peace River Facility Phase II Capacity Increase and ASR Wellfield Expansion	4.5	2024	2027
Peace River Facility Surface Water System Expansion	15.0	2025	2031
Peace River Facility RO Facility and Brackish Wellfield	5.5	2034	2038
Total Additional Yield (MGD)	24.5		

4.3.1.1 Peace River Facility Raw Water ASR

The Authority's potable water ASR system has been a critical water storage component that compliments the off-stream reservoirs, enabling the Authority to manage seasonal demands with stored water when flows from the Peace River are too low or water quality is not optimal for treatment. The potable water ASR system, as currently permitted and operated, requires that the stored water be fully treated to drinking water standards prior to recharge into the aquifer and then fully treated again when the stored water is recovered to the reservoir system. This makes storing water in the ASR system economically less favorable for the Authority (at least twice as expensive under most operating scenarios) than storing raw surface water in the off-stream reservoirs, which

only requires treating the surface water supply once prior to distribution. Even with the higher operational cost, the potable ASR system has been an important water resource asset, providing the Authority with additional storage, drought tolerance, and redundancy to the off-stream reservoirs.

Converting the ASR system to a partially treated water (PTW) ASR system (recharge and storage of filtered raw water from Reservoir No. 1) would significantly reduce the treatment cost of operating the ASR system, since it would only require full treatment to drinking water standards one time, when recovered from ASR storage. In addition, PTW ASR storage may result in improved aquifer water quality, as chemicals from the full water treatment process add about 75 milligrams per liter (mg/L) of inorganic salts to the water (mostly sulfate). Thus, the PTW being recharged would have approximately 25% lower total dissolved solids (TDS) concentrations than potable water recharged under current conditions. Furthermore, finished water would be commensurately better in quality as well, as it will no longer have two full intervals of treatment chemical application.

Uncoupling the ASR system's source water from the requirement of full treatment would eliminate the need to rely on excess treatment capacity for recharging the ASR system, thereby allowing the treatment capacity that is currently reserved for ASR storage to be reallocated toward meeting customer demands. In addition, storing inexpensive partially-treated water in ASR facilitates over-recharging the system. This could offset the impacts of local/regional groundwater withdrawals and contribute to SWFWMD's recovery plan goals for the Southern Water Use Caution Area (SWUCA) by increasing aquifer levels.

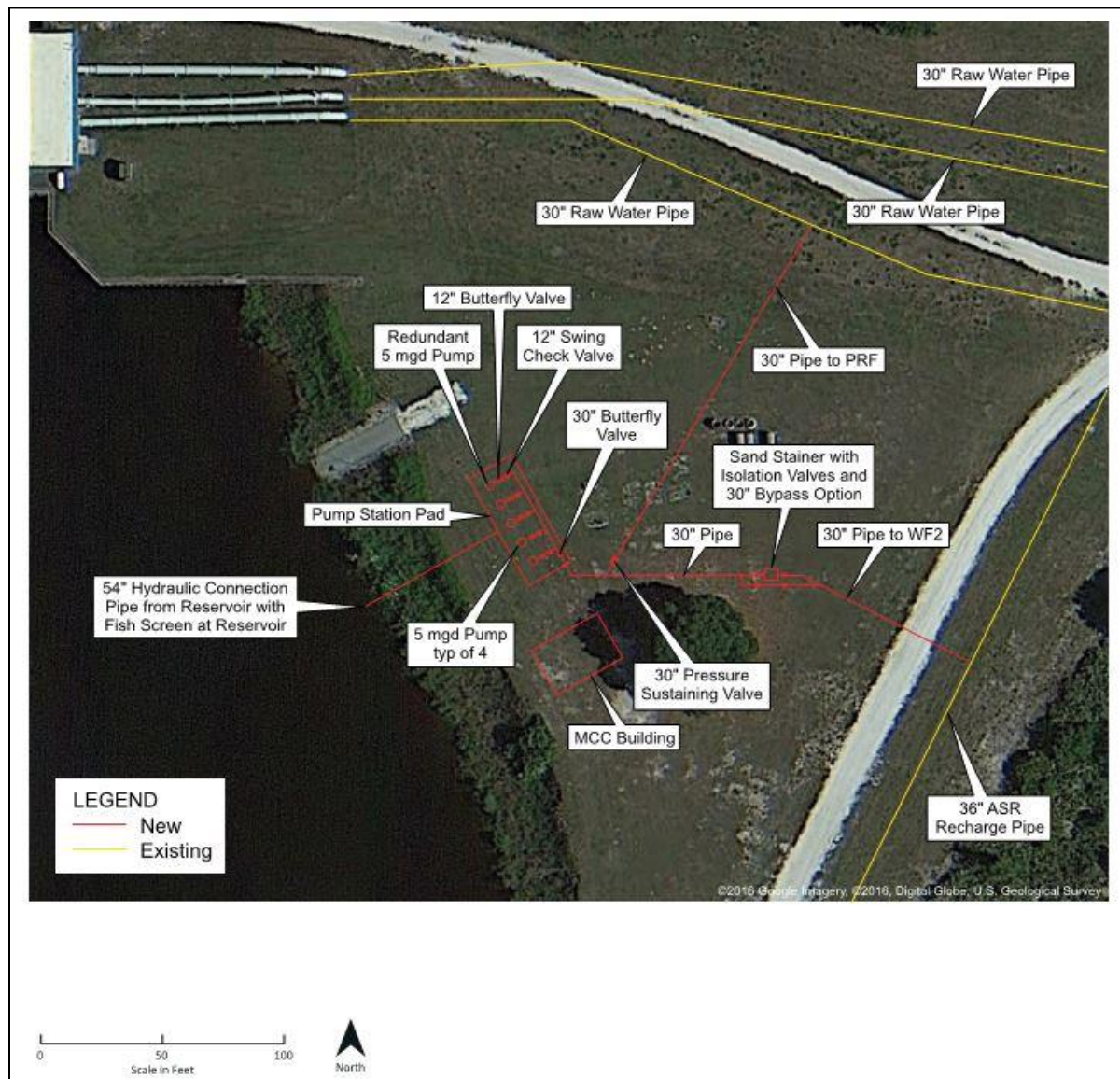
To operate the ASR system more efficiently and realize the benefits outlined above, the Authority is pursuing conversion of the ASR system from potable water to PTW. A desktop study was prepared to evaluate PTW ASR (*Partially Treated Surface Water ASR Desktop Study*, CH2M and ASRus, March 2016). Based on the recommendation in that study, the Authority submitted a request for a modification of the ASR permit to allow limited testing of PTW ASR to evaluate water quality and operational considerations. The permit major modification (136595-016-017-UO/M5) was issued by the FDEP December 14, 2016.

A pilot test using PTW was conducted at ASR wells S-4 and S-20 in ASR Wellfield No. 2. The testing began in February 2017 and concluded in January 2018. The primary regulatory challenge faced with conversion of ASR system to PTW is total coliform, which is ubiquitous in surface water bodies and therefore is present at relatively high levels in the PTW. The groundwater discharge standard for total coliform is 4 colony forming units (CFU) per 100 milliliters (mL). The PTW pilot testing demonstrated that while total coliform counts were observed at high levels as far away as monitor well M-15 (located approximately 1,100 down gradient of S-20), they decline rapidly after the PTW recharge period is ceased. The "die-off" or "inactivation" period to reach the regulatory groundwater

standard of 4 CFU/100 mL from a too-numerous-to-count CFU/100 mL was between three and four weeks based on the data collected from the monitor wells.

Based on the success of the pilot testing, the Authority submitted an operation permit renewal application that requested the use of PTW at the ASR wellfields. One important aspect of this application is that it also allows the Authority to continue operating the ASR system as a potable water ASR system, providing flexibility in future operation and implementation strategies for converting the ASR system. The permit application is currently under review by the FDEP and has been deemed complete. The *Partially Treated Surface Water ASR Desktop Study* (CH2M and ASRus, March 2016) developed a full-scale implementation concept shown in Figure 4.2.

Figure 4.2 - PTW ASR Pump Station Expansion (CH2M and ASRus, 2016)



The PTW ASR concept included the following infrastructure:

- 20 MGD vertical turbine pump station with fish screening and sand strainers
- Electrical building
- Pump station connection to Reservoir No. 1
- 30-inch piping to WF2 and PRF

The capital cost in 2016 was determined to be \$7.5M. This cost has been carried forward and escalated with values according to ENR. The total capital cost and O&M cost for the Raw Water ASR pilot project is expected to be \$8.3M and 0.9M, respectively.

4.3.1.2 Peace River Facility Phase II Capacity Increase and ASR Wellfield Expansion

The Authority is planning to increase their current PRF rated treatment capacity of 51 MGD by 4.5 MGD to 55.5 MGD and add twelve new ASR wells to create additional wellfield recovery capacity to the reservoir system. Additional plant improvements are expected to include adding additional alum storage capacity, adding an additional high service pump at Reservoir No. 1, and adding a third sludge press; however, other minor improvements, to be determined during the design phase, may be necessary. The project is currently scheduled to begin preliminary design in 2024.

If PTW ASR, as explained above, is successfully permitted, expansion of the Authority's ASR wellfield becomes an economically viable option to increase this water storage resource. The ASR expansion would be constrained by some of the same limitations of the existing ASR system. For example, the distance of the wells to the property under the control of the Authority will be an important regulatory consideration to assure that drinking water standards are met at the property boundary. This may limit the number of wells and the volume of storage committed to the wells to assure regulatory standards are met at these institutional control boundaries. However, with the amount of land available at the RV Griffin Reserve, these limitations are not considered to be a significant deterrent to the expansion of ASR at the PRF. Also, a wellfield expansion could be designed to place the wells within the property boundary and space them appropriately to limit upconing (movement of more saline water from below the ASR storage zone). Regardless, some contribution of water from below is expected, and therefore, TDS concentrations will increase during extended recovery periods. This could be mitigated by aquifer recharge options which are discussed in more detail in the following section.



Planning level costs were determined for the Peace River Facility Phase II Capacity Increase and ASR Wellfield Expansion based on individual estimation of the following components:

- Twelve ASR Wells.
- Two Aquifer Recharge Wells.
- Two Avon Park Monitoring Wells.
- Four Suwannee Limestone Monitoring Wells.
- Two Hawthorn Aquifer System (HAS) Monitoring Wells.
- One 20,000 gallon alum storage tanks and two (2) feed systems.
- One sludge press.
- One high service pump.
- Pipelines & miscellaneous infrastructure.

The estimated total capital cost for the Peace River Facility Phase II Capacity Increase and ASR Wellfield Expansion is \$32.3M. Based on the total capital cost amortized over a 30-year useful life at an annual interest rate of five 5%, the unit capital cost for the Peace River Facility Phase II Capacity Increase and ASR Wellfield Expansion is expected to be \$1.28 per 1,000 gallons of treated water. This cost is based on an additional source water yield capacity of 4.5 MGD.

The estimated total annual O&M cost for the Peace River Facility Phase II Capacity Increase and ASR Wellfield Expansion is expected to be \$1.3M. Based on the total annual O&M costs, the unit O&M cost for the Peace River Facility Phase II Capacity Increase and ASR Wellfield Expansion is expected to be \$0.81 per 1,000 gallons of treated water.

The total unit cost for the Peace River Facility Phase II Capacity Increase and ASR Wellfield Expansion based on capital and O&M costs is expected to be \$2.09 per 1,000 gallons of treated water. Table 4.3 provides a summary of all costs and includes total and unit costs.

Table 4.3 - Peace River Facility Phase II Capacity Increase and ASR Wellfield Planning Cost Estimates

Yield (MGD)	Capital Cost (Millions \$)	Capital Cost (\$/1,000 gallons)	Annual O&M Cost (Millions \$)	O&M Cost (\$/1,000 gallons)	Total Cost (\$/1,000 gallons)
4.5	\$32.3	\$1.28	\$1.3	\$0.81	\$2.09

4.3.1.3 Peace River Facility Surface Water System Expansion

As indicated in the Authority's CIP, reliability modeling conducted by the Authority has reflected a 15 MGD additional yield in finished water capacity by constructing 138 MGD of additional Peace River diversion pumping for a total of 258 MGD, conveyance to a new 6 BG Reservoir for additional raw water storage for a total of 12.5 BG in the reservoir system, and a PRF treatment capacity expansion of 26 MGD. This project provides maximum utilization of the additional harvesting opportunity of freshwater flows now allowed by the Authority's recently-issued 50-year WUP. The following considerations are noted as part of this 2020 Plan for implementation of this project.

The current River Diversion Pump Station is constructed for an installed pumping capacity of 120 MGD with 4 pumps, each at a design flow rate of 30 MGD. In 2018, the Authority hired Jacobs Engineering to perform a structural inspection of the pump station internals, wingwalls, and intake screens. The Special Inspection at the Peace River Intake Pump Station Condition Assessment and Repair Recommendations summarized that the inspected components are in overall fair condition. The report noted heavy scaling and large spalls on the chamber concrete interiors, moderate corrosion on the sluice gates, minor leaking of the river intake sluice gates, minor corrosion on flow-through piping, corrosion on butterfly valve operator couplings, and severe corrosion of the intake debris screens. The total recommended cost for improvements of these internals was estimated to be \$1.1M (Jacobs, 2018).

The current River Diversion Pump Station is downstream of County Road 761. In considering the expansion of the river diversion pumping capacity, it may benefit the additional pumping capacity to be constructed upstream of the current pump station. As stated in Section 4.7 below, river water quality could lessen over time as sea level rises. A siting study is recommended to evaluate the cost/benefit of expanding the river diversion pumping upstream along the Peace River.

In 2016, the Authority hired HDR to complete a Reservoir No. 3 Desktop Conceptual Siting Study. The study analyzed three potential sites for a new 6 BG Reservoir on the RV Griffin Reserve and concluded that the primary consideration of siting the new reservoir is mitigation for impacts to existing wetland habitats and floodplain compensation.

In 2007, a 1,055-acre portion of the RV Griffin Reserve was permitted to offset impacts from Reservoir No. 2. Both wetlands and uplands within this permitted mitigation area were restored to generate wetland mitigation credits. Any wetland or upland impacts to the mitigation area from the construction of Reservoir No. 3 or other PRF expansion efforts would require mitigation. In all areas outside of the permitted mitigation area, mitigation would only be required for wetland, not upland,



impacts. Outside of the mitigation area, the RV Griffin Reserve property contains approximately 1,228 acres of wetland habitat.

In December 2018, to aid the Authority in siting Reservoir No. 3, EarthBalance developed a geospatial analysis tool to calculate potential mitigation requirements of any given reservoir footprint. This tool utilizes field data to estimate the number of mitigation credits that would likely be required for a given reservoir footprint. This tool is currently capable of assessing the potential mitigation requirements for wetland and upland impacts within the mitigation area, on RV Griffin Reserve, or wetland impacts on the neighboring Boran Ranch property.

Due to the high ecological value of the mitigation wetlands and the cost of mitigating upland impacts, construction within the permitted existing mitigation area would likely be very expensive. So, any new facilities constructed on the RV Griffin property would likely remain outside the previous mitigation area. Given this information and the large footprint of the proposed PRF expansion, total on-site mitigation will likely not be an option for the proposed expansion projects. The Authority is currently in the process of evaluating other mitigation options including off-site permittee-responsible mitigation, the purchase of credits from a mitigation bank, or a combination of the two.

Although a 6 BG capacity has previously been assumed for Reservoir No. 3, many variables could influence the final design capacity. A few of these variables include the implementation of PTW ASR and Wellfield No. 2 expansion, the amount of wetland mitigation and floodplain compensation achievable at RV Griffin Reserve, and the cost of securing additional acreage for wetland mitigation and floodplain compensation. It is unlikely that the RV Griffin Reserve will be able to accommodate a 4th Reservoir, therefore, the storage capacity must be evaluated carefully to support long term reliability. It is recommended that a siting study be performed in conjunction with reservoir capacity and water supply sustainability needs.

In addition to the preliminary environmental investigations for Reservoir No. 3, in 2017, the Authority hired HDR to perform a Site Master Plan Update for the PRF. The site plan concluded that sufficient space was available on the PRF property for the following:

- An additional 24 MGD capacity treatment train similar to what was added during the 2009 Regional Expansion Program.
- Additional sludge thickeners, a new MCC Building, chemical storage facilities, a new generator and fuel tank
- New Maintenance Facility and warehouse (currently under construction)
- Two 2 MG ground storage tanks for finished water
- 4.0-acre wet detention pond for on-site stormwater management (completed construction)

As noted, some of these site improvement projects, including the new stormwater pond, have either been completed or are currently being constructed. A minimum 5 MGD Reverse Osmosis (RO) Treatment Plant for Brackish Groundwater (discussed in the following section as a separate project) will also be able to fit on the Peace River Water Treatment Plant site.

Planning level costs were determined for the Peace River Facility Surface Water System Expansion based on individual estimation of the components described above for two potential pump station locations. Option A considers the new pump station within proximity of the PRF, while Option B considers the alternate pump station offsite from the PRF. It was assumed that the only difference in cost between these two options is the difference in length of piping from the pump station to Reservoir No. 3.

The estimated total capital costs for the Peace River Facility Surface Water System Expansion are expected to be \$332.2M and \$339.5M, respectively, for Option A and B. Based on the total capital cost amortized over a 30-year useful life at an annual interest rate of 5% and a water source yield of 15 MGD, the unit capital cost for the Peace River Facility Surface Water System Expansion is expected to be \$3.95 and \$4.03 per 1,000 gallons of treated water, respectively, for Option A and B.

The estimated total annual O&M cost for Peace River Facility Surface Water System Expansion is expected to be \$5.4M and \$5.5M for Options A and B, respectively. Based on the total annual O&M costs, the unit O&M cost for the Peace River Facility Surface Water System Expansion is expected to be \$0.99 and \$1.00 per thousand gallons for Options A and B, respectively.

The total unit cost for the Peace River Facility Surface Water System Expansion based on capital and O&M costs is expected to be \$4.94 and \$5.03 per 1,000 gallons of treated water, respectively, for Option A and B. Table 4.4 provides a summary of all costs.

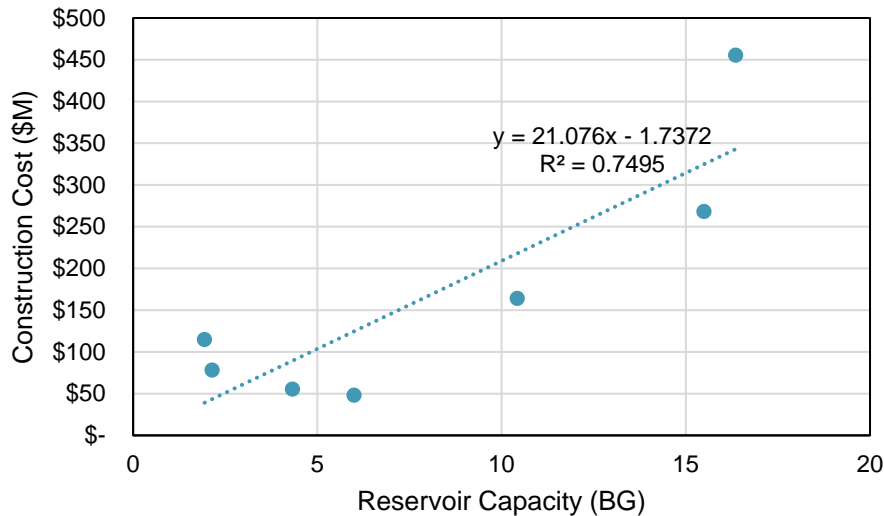
Table 4.4 - Peace River Facility Surface Water System Expansion Cost Estimates

Option	Yield (MGD)	Capital Cost (Millions \$)	Capital Cost (\$/1,000 gallons)	Annual O&M Cost (Millions \$)	O&M Cost (\$/1,000 gallons)	Total Cost (\$/1,000 gallons)
A	15	\$332.2	\$3.95	\$5.4	\$0.99	\$4.94
B	15	\$339.5	\$4.03	\$5.5	\$1.00	\$5.03

As the Authority plans for the capacity of Reservoir No. 3, the construction costs of reservoirs can vary greatly. To determine the cost of the 6 BG reservoir, a cost capacity relationship was developed using empirical cost methods (US DOI/BOR, 2017) based on previously constructed reservoirs in the state of Florida including Tampa Bay Water, Caloosahatchee River, Taylor Creek, and others. Figure

4.3 shows the relationship between various reservoirs constructed in the state of Florida. All costs have been escalated to present market value using the 2019 Engineering News-Record (ENR, 2019) Cost Indices for present day comparative purposes.

Figure 4.3 - Empirical Cost-Capacity Reservoirs Costs



Sources: SWFWMD Water Supply Cost Estimation Study (2007), SWFWMD Caloosahatchee River (2017), Internal Sources

4.3.1.4 Peace River RO Facility and Brackish Wellfield

The development of brackish groundwater resources at the PRF has been evaluated and documented in the Preliminary Investigation of Brackish Groundwater Development Opportunities at the Peace River Facility Resource Evaluation (CH2M HILL, 2011).

Three hydrologic producing zones were evaluated as potential groundwater sources at the PRF: the HAS, the Suwannee Limestone permeable unit, and the upper Avon Park permeable unit. Note that recently, the preferred nomenclature adopted by SWFWMD for the Intermediate Aquifer System in west central Florida is the Hawthorn aquifer system (HAS) where the Hawthorn Group formation is present and the Avon Park permeable zone is more accurately defined as the Avon Park high permeability zone (APHPZ) present within the Lower Floridan aquifer below Middle Confining Unit I (LFA I). Groundwater resources were evaluated based on water quality, production capacity, and permitting feasibility.

The report concluded that HAS and APHPZ were considered the two most viable options in terms of sustainable water quality and utilizing a combination of both the HAS and Avon Park permeable units may provide the best use of the available resources. The HAS is a fresh water zone requiring little treatment to achieve potable drinking water standards, making it economically desirable.

However, potential effects upon existing legal users in the HAS would need to be evaluated further in order to ensure protection of legal existing users. The APHPZ has the poorest water quality, but also the fewest existing legal users.

The APHPZ was recommended as the primary groundwater resource for the development of brackish groundwater at the PRF with the development of the HAS as a supplement to the APHPZ raw water to provide blending opportunities, which could optimize treatment flexibility and tolerance to potential water quality changes in the APHPZ. Both APHPZ and HAS groundwater resources at the PRF were found to be capable of supplying a combined raw water in excess of the proposed 6.2 MGD supply, and the water quality is suitable for membrane treatment. However, groundwater flow modeling recently conducted for the Authority indicates that only a portion of that 6.2 MGD can be withdrawn without causing drawdown upon the SWIMAL, unless some type of Net Benefit is undertaken to offset such new impacts (e.g. aquifer recharge at the PRF, or other similar impact offset action). Ideally, an optimal balance of supply from the HAS and the APHPZ should be identified to accomplish a permissible project that is economically and technically feasible.

In conjunction with the evaluation of brackish groundwater resources, options for disposal of the concentrate generated from a desalinization treatment process were evaluated in the report Preliminary Investigation of Brackish Groundwater Development Opportunities at the Peace River Facility, Evaluation of Concentrate Disposal Options (CH2M HILL, 2011). The report concluded that deep well injection was the most feasible option for concentrate disposal at the PRF. Subsequently, a test well was drilled into the Lower Floridan Aquifer (LFA) to explore if conditions exist at the PRF for a Class I industrial injection well capable of the relatively low flow rates generated from a desalinization facility. The results of the exploratory well suggested that adequate permeability exists in the LFA to accommodate concentrate disposal at the PRF. The results of the exploratory well investigation were documented in the report Preliminary Investigation of Brackish Groundwater Development Opportunities at the Peace River Facility, Well Completion Report for the Peace River Exploratory Well (CH2M HILL and ASRus, 2013).

Since brackish water development at the PRF or Aquifer Recharge opportunities at the PRF would both target the APHPZ, the Authority should carefully consider which program has the greatest benefit for resilient, long-term water supply. It may be possible for the two projects to co-exist with sufficient separation, and the two projects could possibly support each other. For example, impacts related to the brackish water development would be offset by a successful Aquifer Recharge program, providing a more straightforward Water Use Permitting (WUP) strategy. The freshwater recharged in an Aquifer Recharge well could also provide a sustainable brackish water supply in the range of 3,000 to 4,000 mg/L TDS concentration, where TDS concentrations in the APHPZ may



otherwise increase over time without an Aquifer Recharge well operating in tandem with the brackish water wellfield.

Treatment options for the brackish groundwater were conceptualized in a report titled Preliminary Investigation of Brackish Groundwater Development Opportunities at the Peace River Facility – Conceptual Design of Reverse Osmosis Facilities (CH2M HILL, 2013). This report identified withdrawing 6.2 MGD exclusively from the HAS could potentially impact existing users. To provide a finished water of 5.5 MGD, up to 3 wells from the Avon Park aquifer system would supply 5.0 MGD that would be pretreated with sand strainers, cartridge filters, and scale inhibitor prior to RO Treatment through two skids with dedicated feed pumps and membrane cleaning systems. Assuming an 80% recovery efficiency, the RO permeate would yield 4.0 MGD. Up to three additional wells from the HAS would supply 1-2 MGD of water that would blend with the RO permeate to improve water quality stability prior to degasification and chemical post-treatment.

Planning level costs were determined for the Peace River Facility RO Facility and Brackish Wellfield based on individual estimation of the following components:

- Three Avon Park production wells and monitoring wells.
- Three HAS wells and monitoring wells.
- One 5 MGD capacity RO treatment facility.
- Two deep well injection concentrate disposal wells and monitoring wells.

The estimated total capital cost for the Peace River Facility RO Facility and Brackish Wellfield is expected to be \$58.3M. Based on the total capital cost amortized over a 30-year useful life at an annual interest rate of 5%, the unit capital cost for the Peace River Facility RO Facility and Brackish Wellfield is expected to be \$1.89 per 1,000 gallons of treated water.

The estimated total annual O&M cost for the Peace River Facility RO Facility and Brackish Wellfield is expected to be \$4.1M. Based on the total annual O&M costs, the unit O&M cost for the Peace River Facility RO Facility and Brackish Wellfield is expected to be \$1.2.07 per 1,000 gallons of treated water.

The total unit cost for the Peace River Facility RO Facility and Brackish Wellfield based on capital and O&M costs is expected to be \$3.96 per 1,000 gallons of treated water. Table 4.5 provides a summary of all costs and includes total and unit costs.

Table 4.5 - PRF RO Facility and Brackish Wellfield Planning Level Cost Estimates

Yield (MGD)	Capital Cost (Millions \$)	Capital Cost (\$/1,000 gallons)	Annual O&M Cost (Millions \$)	O&M Cost (\$/1,000 gallons)	Total Cost (\$/1,000 gallons)
5.5	\$58.3	\$1.89	\$4.1	\$2.07	\$3.96

4.3.2 Buffalo Creek Wellfield

As discussed in Section 2.1.4 of this report, Manatee County anticipates constructing a 3.950 AAD and PMD brackish groundwater supply wellfield adjacent to the Buffalo Creek Golf Course and corresponding RO treatment facility that will have a finished water capacity of 3.0 MGD by 2033. The withdrawal is included in the County's Consolidated Water Use Permit, #20013343. Permits for the wells and water lines were issued in 2009 but were subsequently withdrawn in 2014 when the project timeline was moved beyond the CIP. This project site is also adjacent to the County's North Regional Water Reclamation Facility. The 2015 Plan stated that the groundwater source will be the Suwannee Limestone permeable unit and the HAS via 5 wells and eight wells, respectively, and the associated pumping, piping, chemical facilities, buildings, and site would be sized to give the facility the ability to be expanded to 5 MGD. The 3.0 MGD of finished water would consist of a blend of approximately 2.1 MGD of RO permeate and approximately 0.9 MGD of filtered raw water from the HAS.

The 2015 Plan indicated that the cost of this facility was projected to be \$25.5M which included the concept of blending the RO concentrate with reclaimed water in a storage pond at the Buffalo Creek Golf Course, which was a recommended concept as part of the Manatee County – Reverse Osmosis Basis of Design (McKim and Creed, 2008). Since 2015, Manatee County has installed two Class I Deep Injection Wells at their North Regional Water Reclamation Facility for excess reclaimed water disposal. One of those deep injection wells was completed to Class I industrial injection well standards which will allow disposal of RO concentrate. Thus, the RO concentrate can be disposed of in the Class I Industrial Injection Well instead of in the reclaimed water storage pond. The Manatee County Water Supply Facilities Work Plan 2017 (Carollo, 2017) included the cost of this facility to be \$36M. These costs have been updated to approximately \$38.3M based on an evaluation of the associated components and an estimated price increase as reported in the 2019 Engineering News-Record (ENR, 2019) and RSMeans Historical Construction cost indices (RSMeans, 2019). No additional escalation will likely be required for this project due to minimal changes in market costs since 2017. Utilizing an additional finished water capacity of 3 MGD, the capital cost per thousand gallons of additional water supply based on amortizing the \$38.3M over a 30-year duration at 5% annual interest is \$2.28.

The estimated total annual O&M cost for the Buffalo Creek Wellfield is expected to be \$2.7M. Based on the total annual O&M costs, the unit O&M cost for the Buffalo Creek Wellfield is expected to be \$2.45 per 1,000 gallons of treated water.

The total cost is expected to be \$4.72 per thousand gallons of finished water produced. Table 4.6 summarizes yield and estimated costs for this groundwater development project.

Table 4.6 - Buffalo Creek Wellfield Planning Level Cost Estimates

Yield (MGD)	Capital Cost (Millions \$)	Capital Cost (\$/1,000 gallons)	Annual O&M Cost (Millions \$)	O&M Cost (\$/1,000 gallons)	Total Cost (\$/1,000 gallons)
3.0	\$38.3	\$2.28	\$2.7	\$2.45	\$4.72

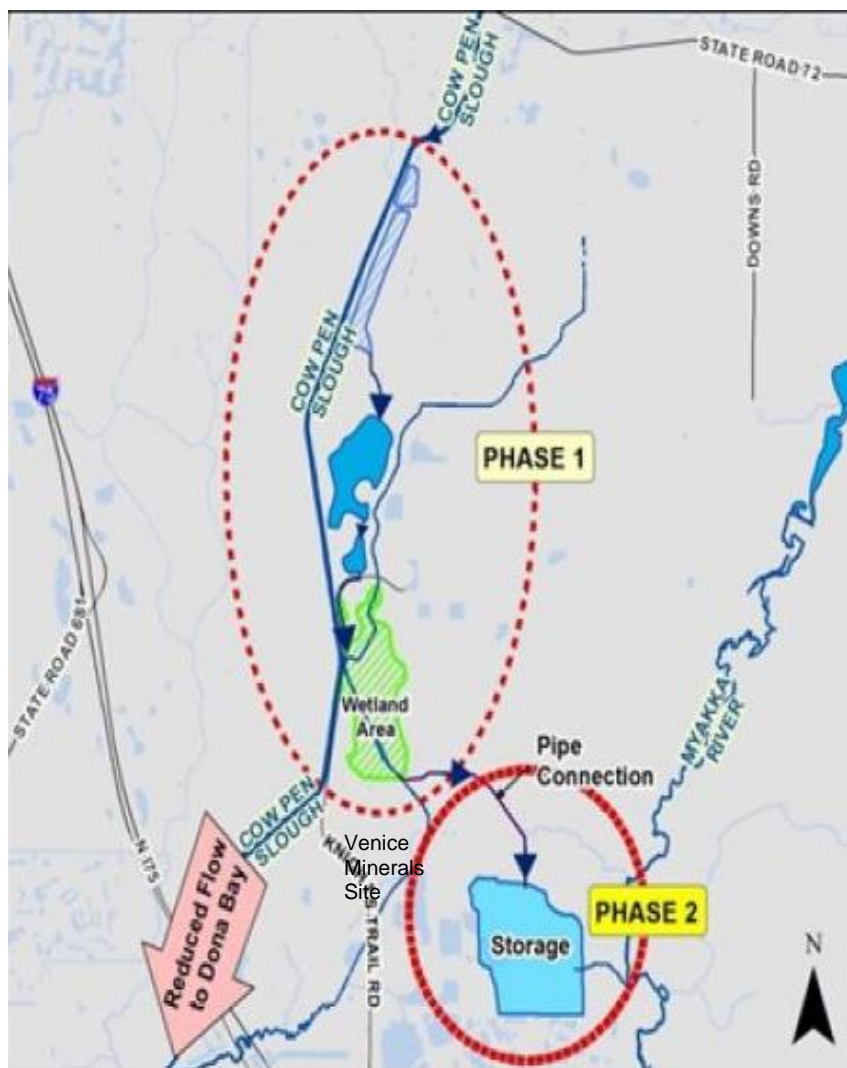
4.3.3 Cow Pen Slough

Dona Bay receives water from three tidal creeks (Fox Creek, Shakett Creek, and Salt Creek) as well as the Cow Pen Slough located in the Myakka River watershed, which is drained now by Cow Pen Canal and discharges to Shakett Creek. The Cow Pen Canal was constructed in the 1960s which increased the Dona Bay watershed from 16 square miles to 74 square miles and introduced a significantly greater volume of fresh water to Dona Bay than prior to canal construction. Therefore, Dona Bay's historic salinity concentrations increased significantly in variability and impacted the Dona Bay ecosystem that existed prior to the 1960s.

Sarasota County has made progress in improving the water quality in the historically saline Dona Bay through an initiative to divert a portion of flow from Cow Pen Slough to several wet detention areas and to the Pinelands wetland area for hydrologic restoration as well as to a new freshwater storage facility. Sarasota County has begun to implement this diversion project in two phases: Phase 1, termed the Dona Bay Conveyance Improvements, encompasses the Cow Pen Slough flow diversion system to the wetland detention areas and Pinelands wetland area. Construction of this phase was substantially completed March 2017.

Sarasota County is currently designing Phase 2 of this initiative, termed the Dona Bay Surface Water Storage Facility. This storage facility is planned to utilize the former Venice Minerals borrow pit area as a 370-acre wet detention area with water level control structures which will receive flows downstream of the Pinelands wetland area via a 72-inch pipeline to the Venice Minerals reservoir site. Construction completion for this Dona Bay Surface Water Storage Facility is anticipated to be completed in 2023. These two phases are aimed at reducing nutrient levels, peak flows, and freshwater volume that has been discharging to Dona Bay, thereby providing natural treatment by increasing residence time for the diverted surface water that is rerouted back into the Myakka River Basin. Figure 4.4 illustrates the project's two phases.

Figure 4.4 - Cow Pen Slough Diversion Project (Sarasota County CIP, May 2019)



The 2015 Plan identified the potential to create up to 15 MGD of potable water supply from the Cow Pen Slough diversion, a concept that was created in the Dona Bay Watershed Management Plan (Sarasota County and SWFWMD, 2007). The Authority's Source Water Feasibility Study for the Upper Myakka River, Shell and Prairie Creeks, and Dona Bay Watersheds (PBS&J, 2009) confirmed that there is excess surface water in the Myakka watershed upstream of the upper weir of the Cow Pen Canal. The analysis was consistent with the MFL established for the Lower Myakka River in 2011 (PBS&J, 2009). Currently, this MFL is not scheduled to be reassessed through 2027.

Beyond the currently planned projects by Sarasota County, creation of a 5 MGD water supply could be achieved as stated in the 2015 Plan by adding a Reservoir Pump Station and raw water transmission main from the Venice Minerals Reservoir to the Carlton Reserve site for treatment. Future expansion through the additional reservoir storage on the Albritton property upstream of Venice Minerals could bring total yield of this project to 15 MGD. However, the Albritton site is

currently providing daily soil cover for the landfill. Use of this site for water storage will have to wait until the mining operations are complete, which is past the 20-year planning horizon for this report. The surface water quality is seasonally variable in salinity, likely requiring a membrane treatment process. Management of the concentrate produced from the membrane treatment process could be performed through injection well disposal. Site specific investigation of the geology and hydrogeology would need to be completed to determine concentrate disposal capacities via injection wells. The Lower Floridan aquifer (LFA) may be the only disposal option available. The capacity of LFA wells is limited and significantly less than the traditional “boulder zone” high capacity wells in south Florida.

Planning level costs were determined for Cow Pen Slough based on individual estimation of the following components:

- One 5 MGD capacity pump station at the Venice Minerals site to be completed.
- Treatment facility upgrades, including pretreatment system, one 5 MGD EDR unit system at the Carlton Reserve.
- Pipelines & miscellaneous infrastructure.

The estimated total capital cost for Cow Pen Slough is expected to be \$82.8M. Based on the total capital cost amortized over a 30-year useful life at an annual interest rate of 5%, the unit capital cost for Cow Pen Slough is expected to be \$2.95 per 1,000 gallons of treated water.

The estimated total annual O&M cost for Cow Pen Slough is expected to be \$3.7M. Based on the total annual O&M costs, the unit O&M cost for Cow Pen Slough is expected to be 2.05 per 1,000 gallons of treated water.

The total unit cost for Cow Pen Slough based on capital and O&M costs is expected to be \$5.00 per 1,000 gallons of treated water. Table 4.7 provides a summary of all costs and includes total and unit costs.

Table 4.7 - Cow Pen Slough Planning Cost Estimates

Yield (MGD)	Capital Cost (Millions \$)	Capital Cost (\$/1,000 gallons)	Annual O&M Cost (Millions \$)	O&M Cost (\$/1,000 gallons)	Total Cost (\$/1,000 gallons)
5.0	\$82.8	\$2.95	\$3.7	\$2.05	\$5.00

4.4 2015 Plan Projects Carried Forward with No Further Action

4.4.1 DeSoto County Brackish Wellfield

The 2015 Plan stated that the Authority entered into a Memorandum of Understanding with DeSoto County to evaluate the development of a brackish water supply with a capacity of up to 5 MGD at the DeSoto County Department of Juvenile Justice and/or DCI facilities for treatment and interconnection to the Authority's regional system. This Memorandum of Understanding expired on July 31, 2017. The two wells at the DeSoto County Department of Juvenile Justice were rolled into the Authority's new WUP as standby wells. As discussed in Section 2.1.3, the Authority anticipates an interconnection of the isolated DCI area to the portion of Desoto County's system that is currently supplied by the Authority by 2024.

The 2015 Plan outlined a potential water treatment facility with infrastructure as follows:

- Expansion of the existing groundwater wellfield at the DCI site to produce 5 MGD from the Suwannee Limestone permeable unit (located below the HAS) and produce 1-2 MGD from the HAS
- Construction of a 5 MGD RO Facility to treat brackish water from the Suwannee Limestone permeable unit. Assuming a 20% treatment loss, the treated water yield will be 4 MGD.
- Blend 1-2 MGD from the HAS with the RO Facility permeate prior to degasification and chemical post-treatment, which would yield 5-6 MGD finished water.
- Install a ten mile 16-inch transmission main with booster pump station to connect the system to the Authority's regional transmission system through the County's existing transmission mains

The 2015 Plan allocated the total cost of this project to be \$40.1M. Included within this cost is \$6.3M for the booster pump station and transmission main. Most of the \$6.3M cost will be offset if DeSoto County proceeds to add this pipeline as mentioned in Section 2.1.3 of this report.

The 2015 Plan did not include options for the disposal of the concentrate produced from the RO treatment process. For the purpose of cost estimation, a deep injection well into the LFA with a capacity for disposal of 1-2 MGD of concentrate is assumed.

Planning level costs were determined for the DeSoto County Brackish Wellfield based on individual estimation of the following components:

- One 4 MGD capacity RO treatment facility.
- Six Suwannee Limestone production wells and monitoring wells.

- Three HAS production wells and monitoring wells.
- Two deep well injection concentrate disposal wells and monitoring wells
- Pipelines & miscellaneous infrastructure (includes 10-miles of conveyance piping).

The estimated total capital cost for the DeSoto County Brackish Wellfield is expected to be \$78.5M. Based on the total capital cost amortized over a 30-year useful life at an annual interest rate of 5%, the unit capital cost for the DeSoto County Brackish Wellfield is expected to \$2.80 per 1,000 gallons of finished water.

The estimated total annual O&M cost for the DeSoto County Brackish Wellfield is expected to be \$4.1M. Based on the total annual O&M costs, the unit O&M cost for the DeSoto County Brackish Wellfield is expected to be \$2.24 per 1,000 gallons of finished water.

The total unit cost for the DeSoto County Brackish Wellfield based on capital and O&M costs is expected to be \$5.04 per 1,000 gallons of finished water. Table 4.8 provides a summary of all costs and includes total and unit costs and includes total and unit costs.

Table 4.8 - DeSoto County Brackish Wellfield Planning Level Cost Estimates

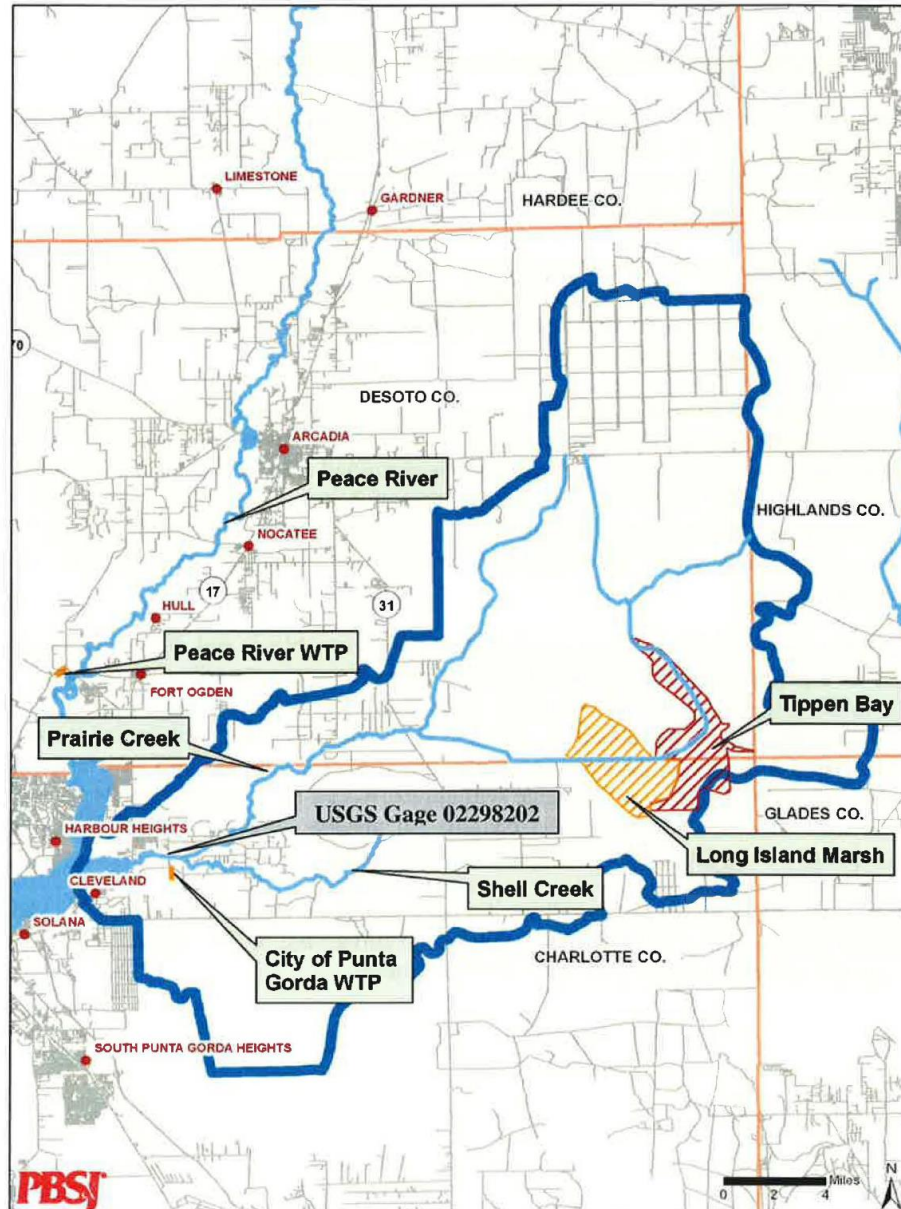
Yield (MGD)	Capital Cost (Millions \$)	Capital Cost (\$/1,000 gallons)	Annual O&M Cost (Millions \$)	O&M Cost (\$/1,000 gallons)	Total Cost (\$/1,000 gallons)
5.0	\$78.5	\$2.80	\$4.1	\$2.24	\$5.04

The total cost for the inclusion 10-miles of 16-inch conveyance piping was estimated to be \$14.7M based upon current market data for the state of Florida provided using RSMeans unit costs with an assumed additional 30% contingency added for fitting and miscellaneous appurtenances, as well as undeveloped plans or considerations. The total capital cost for DeSoto Brackish Wellfield with these costs excluded would result in a total capital cost of \$70.4M. The total O&M cost with exclusion of these costs result in a total annual O&M cost of \$4.2M.

4.4.2 Shell and Prairie Creeks

The 2015 Plan identified Shell and Prairie Creeks as a potential for up to 20 MGD of reliable surface water yield for membrane treatment. The current schedule for MFL adoption for the Shell Creek (lower segment), Shell Creek (upper segment), and Prairie Creek are 2020, 2025, and 2025, respectively. A map showing the surrounding area of the Shell and Prairie Creeks watershed is provided in Figure 4.5.

Figure 4.5 - Shell and Prairie Creeks Watershed (PBS&J, 2009)



The 2015 Plan recommended the following infrastructure:

- 6.5-billion-gallon reservoir in the lower watershed
- 100 cfs maximum intake structure located near the confluence of Shell and Prairie Creeks
- 20 MGD RO WTP near the City of Punta Gorda's Shell Creek WTP
- 5 miles of a 36-inch transmission main to deliver water from the intake structure to the new RO WTP
- Injection well system near the new RO WTP for concentrate disposal

No action is known to have been taken since 2015 to advance this water supply option. Furthermore, it is anticipated that the Lower Shell Creek will be in recovery. No additional withdrawal will be

available in low and mid flow blocks, and the upper block will be restricted to the City of Punta Gorda's current water use permit for the Shell Creek WTP. While a cost has been updated for this concept, its feasibility for implementation is unlikely at this time.

The estimated total capital cost for the Shell and Prairie Creek Improvements is expected to be \$442.4M. Based on the total capital cost amortized over a 30-year useful life at an annual interest rate of 5%, the unit capital cost for the Shell and Prairie Creeks is expected to be \$3.94 per 1,000 gallons of treated water.

The estimated total annual O&M cost for the Shell and Prairie Creek Improvements is expected to be \$24.9M. Based on the total annual O&M costs, the unit O&M cost for the Shell and Prairie Creek Improvements is expected to be \$3.40 per 1,000 gallons of treated water.

The total unit cost for the Shell and Prairie Creek Improvements based on capital and O&M costs is expected to be \$7.35 per 1,000 gallons of treated water. Table 4.9 provides a summary of all costs and includes total and unit costs.

Table 4.9 - Shell and Prairie Creek Improvements Planning Cost Estimates

Yield (MGD)	Capital Cost (Millions \$)	Capital Cost (\$/1,000 gallons)	Annual O&M Cost (Millions \$)	O&M Cost (\$/1,000 gallons)	Total Cost (\$/1,000 gallons)
20	\$442.4	\$3.94	\$24.9	\$3.40	\$7.35

4.4.3 Blackburn Canal

The 2015 Plan developed a water supply concept to for up to 5 MGD of yield from the Blackburn Canal System. Similar to the Cow Pen Canal diversion of freshwater from Cow Pen Slough to Dona Bay, the Blackburn Canal was constructed in the 1950s and 1960s to divert flood waters from the Myakka River watershed to the tidal Curry Creek and Roberts Bay. As part of construction, Curry Creek was straightened and deepened to create an adequate hydraulic connection between Blackburn Canal and Roberts Bay. Because of this diversion, Roberts Bay began receiving approximately 2.5 times more freshwater than historically contributed. As a result, Roberts Bay has experienced a significant decline in seasonal salinities and historic native ecology.

No further action is known to have been taken to develop this water supply concept; however, diversion and use of this freshwater flow could provide a significant benefit to the historic restoration of Roberts Bay. An MFL for the lower Myakka River was established in 2011 and is not currently scheduled for reevaluation; therefore, the 2015 Plan concept is carried forward as a viable source with the following components:

- 30 MGD Blackburn Canal Intake Structure

- 3 BG Off-stream Reservoir
- 5 MGD finished water capacity RO Treatment Facility
- One Deep Injection Well for RO Concentrate
- 16-inch transmission main and booster pump to interconnect to the regional system

Planning level costs were determined for Blackburn Canal are based on individual estimation of the components described above. The estimated total capital cost for Blackburn Canal is expected to be \$179.7M. Based on the total capital cost amortized over a 30-year useful life at an annual interest rate of 5%, the unit capital cost for Blackburn Canal is expected to be \$6.40 per 1,000 gallons of treated water.

The estimated total annual O&M cost for the Blackburn Canal is expected to be \$6.0M. Based on the total annual O&M costs, the unit O&M cost for Blackburn Canal is expected to be \$3.30 per 1,000 gallons of treated water.

The total unit cost for the Blackburn Canal based on capital and O&M costs is expected to be \$9.70 per 1,000 gallons of treated water. Table 4.10 provides a summary of all costs and includes total and unit costs.

Table 4.10 - Blackburn Canal Planning Level Cost Estimates

Yield (MGD)	Capital Cost (Millions \$)	Capital Cost (\$/1,000 gallons)	Annual O&M Cost (Millions \$)	O&M Cost (\$/1,000 gallons)	Total Cost (\$/1,000 gallons)
5.0	\$179.7	\$6.40	\$6.0	\$3.30	\$9.70

4.4.4 Seawater Desalination

As documented in the 2015 Plan, SWFWMD evaluated and included in their 2006 and 2010 Regional Water Supply Plans a series of potential locations for seawater desalination facilities that would align with adjacent land uses, be near existing public water transmission infrastructure, and could be permitted for RO concentrate disposal. SWFWMD also carried forward these potential seawater desalination facilities in their 2015 Regional Water Supply Plan – Southern Planning Region. Two locations were identified in the Authority’s 4-county area: one in Port Manatee and one on an industrial site near the Venice Airport in Sarasota County. Both locations were assumed to develop up to 20 MGD of finished water capacity. These concepts have also been carried into SWFWMD’s 2015 Regional Supply Plan, however, no action has been taken to further develop these concepts prior to this document. The following infrastructure has been assumed so far:

- 440 MGD intake structure of seawater from the surface, of which 40 MGD would be treated

- 40 MGD RO Treatment Facility with 50% efficiency, yielding 20 MGD finished water
- Dilution of the 20 MGD of concentrate with up to 400 MGD of the withdrawn seawater for a 20 to 1 dilution ratio and discharge back to the sea

The Port Manatee and Venice Airport sites were considered in part because the conceptual surface water withdrawal locations were not listed as either Outstanding Florida Water or aquatic preserves; however, consideration of other sites in the future would have to account for these designations (SWFWMD, 2006). Seawater withdrawals from the surface also must mitigate potential entrainment of aquatic life and sediments, and impact to sea grasses and hard-bottom communities (SWFWMD, 2010). Furthermore, the source water would need to be potentially pretreated with coagulation and/or microfiltration similar to fresh surface water treatment so that RO membranes do not foul prematurely (SWFWMD, 2010). Because the salinity of the concentrate is significantly higher than the source water, concentrate disposal to the surface has the potential to impact the benthic communities, which is mitigated by widely dispersed multiple outlets or dilution with the source water to safe levels prior to discharge (SWFWMD, 2010).

The Authority has recently indicated the Port Manatee and Venice Airport site concepts established in two individual cost reports completed by Greeley and Hansen in 2005 will be used in lieu of the SWFWMD's 2015 Regional Supply Plan concept. Planning level costs were determined for the Port Manatee and Venice Airport Seawater Desalination concepts are based on individual estimation of the following components:

- One 40 MGD capacity raw water pump station.
- One 40 MGD RO Treatment Facility yielding 20 MGD finished water
- Three deep well injection concentrate disposal wells.
- Pipelines & miscellaneous infrastructure

The estimated total capital cost for the Port Manatee Seawater Desalination concept is expected to be \$271.8M. Based on the total capital cost amortized over a 30-year useful life at an annual interest rate of 5%, the unit capital cost for the Port Manatee Seawater Desalination concept is expected to be \$2.42 per 1,000 gallons of treated water.

The estimated total annual O&M cost for the Port Manatee Seawater Desalination concept is expected to be \$23.0M. Based on the total annual O&M costs, the unit O&M cost for the Port Manatee Seawater Desalination concept is expected to be \$3.16 per 1,000 gallons of treated water.

The total unit cost for the Port Manatee Seawater Desalination concept based on capital and O&M costs is expected to be \$5.58 per 1,000 gallons of treated water. Table 4.11 provides a summary of all costs and includes total and unit costs.

Table 4.11 - Port Manatee Seawater Desalination Planning Level Cost Estimates

Yield (MGD)	Capital Cost (Millions \$)	Capital Cost (\$/1,000 gallons)	Annual O&M Cost (Millions \$)	O&M Cost (\$/1,000 gallons)	Total Cost (\$/1,000 gallons)
20	\$271.8	\$2.42	\$23.0	\$3.16	\$5.58

Consistent with the new infrastructure items to develop the Port Manatee Seawater Desalination concept using deep injection wells for concentrate disposal, the estimated total capital cost for the Venice Airport Seawater Desalination concept is expected to be \$287.4M. Based on the total capital cost amortized over a 30-year useful life at an annual interest rate of 5%, the unit capital cost for the Venice Airport Seawater Desalination concept is expected to be \$2.56 per 1,000 gallons of treated water.

The estimated total annual O&M cost for the Venice Airport Seawater Desalination concept is expected to be \$23.1M. Based on the total annual O&M costs, the unit O&M cost for the Venice Airport Seawater Desalination concept is expected to be \$3.17 per 1,000 gallons of treated water.

The total unit cost for the Venice Airport Seawater Desalination concept based on capital and O&M costs is expected to be \$5.73 per 1,000 gallons of treated water. Table 4.12 provides a summary of all costs and includes total and unit costs.

Table 4.12 - Venice Airport Seawater Desalination Planning Level Cost Estimates

Yield (MGD)	Capital Cost (Millions \$)	Capital Cost (\$/1,000 gallons)	Annual O&M Cost (Millions \$)	O&M Cost (\$/1,000 gallons)	Total Cost (\$/1,000 gallons)
20	\$287.4	\$2.56	\$23.1	\$3.17	\$5.73

4.4.5 Upper Myakka River Surface Water Treatment Facility

There have been numerous investigations exploring the potential of developing surface water supplies in the upper Myakka River watershed over the past decade or more, including the Source Water Feasibility Study for the Upper Myakka River, Shell and Prairie Creeks and Dona Bay Watersheds (PBS&J 2009). Water quality in the tributaries of the upper Myakka River watershed has historically exceeded the secondary TDS drinking water standard, so any facility design should consider including a membrane or ion exchange treatment process. Another issue encountered when assessing this option is that the upper Myakka stream flows vary greatly, with extended periods of little to no flow and short periods of high flows in response to local rainfall. This creates an issue with sizing the resulting facilities in order to accommodate short-term high flows, followed by prolonged periods of no use. In order to reduce the need to oversize the facility to accommodate the periods of high flow, a combined use scenario could be evaluated. This scenario would utilize a



reservoir as a surface water source in conjunction with ground water withdrawals in order to supplement times of low flow. The location being considered for a potential reservoir was proximal to the Flatford Swamp. Based on an intake capacity of 60 cfs and reservoir storage of 5.9 to 6.2 billion gallons, the yield of the upper Myakka system was estimated at 10 to 11 MGD (PBS&J 2009).

Another is that the potential reservoir sites in the upper Myakka River watershed very near the Most Impacted Area of the SWUCA so obtaining a permit for a new groundwater source would be challenging.

According to the PBS&J 2009 study, the most cost-effective option included installation of the following:

- 6.2-billion-gallon reservoir in the vicinity of the Flatford Swamp;
- 60 cfs maximum intake structure;
- 10 MGD RO WTP (for the surface water) near the gulf coast;
- 20-miles of a 30-inch transmission main to deliver water for treatment at a new RO WTP; and,
- A disposal well system near the site of the new WTP

The conceptual design above was included in the Authority's 2015 Plan. Since the 2015 Plan was written, SWFWMD has progressed in planning a concept to passively recharge excess flows within the Upper Myakka Watershed at Flatford Swamp, which are estimated to be approximately 10 MGD AADF from the Upper Myakka System. The concept proposes that excess flows from Coker/Ogelby Creek, Myakka River at Taylor Road, and Maple Creek will be diverted through Flatford Swamp to the Upper Floridan aquifer's APHPZ via five recharge wells between approximately 950 and 1150 ft below land surface (Jones Edmunds, 2016). The full-scale recharge concept could be phased to achieve maximum recharge rates for wet weather flows of 15 MGD or greater. It is also anticipated that the recharge system will need to be converted from passive to pumped at higher flow rates as the recharge well performance naturally begins to decline. SWFWMD has received a construction permit from FDEP to begin a pilot study of this concept with one recharge well. The recharge well and monitoring wells have been constructed, and final design of the surface facilities is nearing completion. This pilot study is anticipated to be complete in 2022, following approximately two years of operational testing. The Authority should explore with SWFWMD the utilization of the Net Benefit opportunity described under Section 4.6 to develop a new groundwater supply near the Flatford Swamp area.

4.5 New Project Concepts

The projects within this subsection are either projects that have initiated after the 2015 Plan and have initial feasibility studies completed or are new concepts for future consideration by the Authority. These project concepts are planning-level in nature.

4.5.1 Flatford Swamp Groundwater Recovery Concept

While the Flatford Swamp Aquifer Recharge initiative is a Water Resource Development (WRD) project, the potential may exist for the Authority to obtain new groundwater quantities in return for Authority participation in accomplishment of the project's water resource benefits (e.g. operation of the system or otherwise). These new groundwater supplies could be developed elsewhere by the Authority to further-drought proof the regional water supply during severe dry periods. These cooperative Aquifer Recharge opportunities should be evaluated, particularly for Aquifer Recharge projects within the Authority's service area. The SWFWMD should support development of cooperative Aquifer Recharge opportunities as a portion of the water recharged is left in the aquifer to assist with the SWUCA recovery efforts. Net Benefit opportunities associated with SWFWMD WRD projects are discussed in greater detail in Appendix B.

Conceptually, it is assumed that a new groundwater supply of 5 MGD could be developed, predicated on receiving groundwater credits for at least 50% of the anticipated Flatford Swamp surface water recharge quantity of 10 MGD AADF. Once the pilot study is completed, groundwater modeling should be completed to confirm the percent of recharge water achievable for groundwater credits. Discussions with SWFWMD would be required to fully understand the methodology to be developed for quantifying the Net Benefit that could be realized from this aquifer recharge project coupled with a potential public water supply. To justify the Authority's partial use of the Net Benefit derived from operating the Flatford Swamp aquifer recharge program, it may be necessary for the Authority to operate the Flatford Swamp aquifer recharge system on behalf of the SWFWMD. The Flatford Swamp recharge project is being designed and constructed by the SWFWMD as a WRD project and is intended to assist the SWFWMD in accomplishing increases in water levels within the Most Impacted Area (MIA) and compliance with the SWIMAL (i.e. MFL). In considering the potential reliability of this project, it should be recognized that the SWFWMD's implementation procedure calls for the SWIMAL to be used to gage the status of the groundwater resource with respect to saltwater intrusion in the region. The SWFWMD's 2002 report entitled "Saltwater Intrusion and the Minimum Aquifer Level in the Southern Water Use Caution Area" states:

"Determining the status of the resource will be based on comparison of the average water level over the MIA for 10-year moving windows of time with the minimum level. The objective of the

District's management efforts is for the 10-year moving average to fluctuate in a range above the minimum level. It is proposed that, the minimum level will have been achieved if the 10-year moving average has fluctuated above the minimum level for a minimum of 5 consecutive years. The goal is to ensure that the system is truly fluctuating above the minimum level and this is not a transient or abnormal condition. It is proposed that, the minimum level has not been met when the 10-year moving average has fallen below the minimum level for more than 2 consecutive years."

Assuming a 5 MGD AADF freshwater supply can be obtained, a 10 MGD UFA wellfield near Myakka City could be constructed that is operated to produce a 5 MGD AADF water supply for the region. This is anticipated to require up to ten production wells averaging 1 MGD each and conventional water treatment facilities capable of treating up to 10 MGD of fresh groundwater. The fresh groundwater will need to be treated for hydrogen sulfide through aeration, softened to remove hardness, and disinfected prior to distribution. For conveyance, approximately 20 miles of 24-inch transmission main would be required to tie into the regional transmission system.

Planning level costs were determined for the Upper Myakka/Flatford Swamp Net Benefit Groundwater Recovery Concept based on individual estimation of the following components:

- Ten Suwannee Limestone Production Wells & Monitoring Wells.
- One 10 MGD Conventional Water Treatment Facility.
- 22-Mile Pipeline
- Well Piping (5,000 linear feet (LF)) & Miscellaneous Infrastructure.

The estimated total capital cost for the Upper Myakka/Flatford Swamp Net Benefit Groundwater Recovery Concept is expected to be \$113.4M. Based on the total capital cost amortized over a 30-year useful life at an annual interest rate of 5%, the unit capital cost for the Upper Myakka/Flatford Swamp Net Benefit Groundwater Recovery Concept is expected to be \$4.04 per 1,000 gallons of treated water.

The estimated total annual O&M cost for the Upper Myakka/Flatford Swamp Net Benefit Groundwater Recovery Concept is expected to be \$1.8M. Based on the total annual O&M costs, the unit O&M cost for the Upper Myakka/Flatford Swamp Net Benefit Groundwater Recovery Concept is expected to be \$1.00 per 1,000 gallons of treated water.

The total unit cost for the Upper Myakka/Flatford Swamp Net Benefit Groundwater Recovery Concept based on capital and O&M costs is expected to be \$5.04 per 1,000 gallons of treated water. Table 4.13 provides a summary of all costs and includes total and unit costs.

Table 4.13 - Upper Myakka/Flatford Swamp Net Benefit Groundwater Concept Planning Cost Estimates

Yield (MGD)	Capital Cost (Millions \$)	Capital Cost (\$/1,000 gallons)	Annual O&M Cost (Millions \$)	O&M Cost (\$/1,000 gallons)	Total Cost (\$/1,000 gallons)
5	\$113.4	\$4.04	\$1.8	\$1.00	\$5.04

4.5.2 Planned Carlton Wellfield Upgrades

As described in Section 2.1.5.4, Sarasota County is in the process of rehabilitating and upgrading their EDR water treatment process to produce a design finished water capacity of 15 MGD by early 2023. The County is in the initial stages of planning for the corresponding Carlton Wellfield upgrades that would provide the treatment system with the ability to meet its maximum treatment capacity. This increased water supply could be developed in multiple ways, such as rehabilitating or replacing poor-performing wells or adding new wells; however, the strategy would need to be permitted. One permitting option is to relocate the existing WUP quantities from the University Parkway Wellfield and the Venice Gardens Wellfield as both of their corresponding water treatment plants are planned to be offline before 2030.

As described in Section 2.1 of this report, Sarasota County's Consolidated WUP No. 20008836.013 authorizes the use of groundwater at three County wellfield facilities: T. Mabry Carlton (Carlton), Venice Gardens (VGU), and University Parkway (UP). The WUP authorizes total combined AAD and PMD brackish groundwater withdrawals of 13,737,400 and 16,499,300 gpd, respectively. The authorized individual wellfield AAD quantities for Carlton, VGU, and UP are 7.303 MGD, 4.435 MGD, and 2.0 MGD, respectively. WUP No. 20008836.013 (Operational Flexibility WUP; OFWUP) also authorizes temporary withdrawal of an additional 5.0 MGD of brackish groundwater (4.0 MGD finished) from the Carlton Wellfield above and beyond the Carlton withdrawals authorized under the County's Consolidated WUP.

Relocation of currently-authorized quantities from the VGU and UP wellfields to the Carlton Wellfield facility in the future has inherent benefits to the MIA. The Carlton Wellfield is located approximately 11 miles to the southeast of the MIA boundary, and VGU is even further away. The proposed self-relocation of VGU would result in permitted VGU withdrawals moving closer to, but still far from the MIA. However, the self-relocation of UP would result in permitted UP withdrawals from far-within the MIA to far-outside the MIA (11 miles or more).

At the Authority's request, Progressive Water Resources, LLC (PWR) conducted preliminary modeling using the SWFWMD's District-Wide Regulation Model Version 3.0 (DWRM 3.0) to assess the potential effects of self-relocating Sarasota County's authorized VGU and UP quantities to



Carlton, with particular focus on the MIA of the SWUCA. This effort was undertaken to preliminarily assess whether the County's proposed self-relocations have the potential to result in recovery of Upper Floridan Aquifer potentiometric surface levels within the MIA, and if so whether such recovery might provide the opportunity for new future groundwater supplies for the region.

The results of PWR's preliminary modeling effort indicate the County's proposed self-relocation will result in substantial recovery of the combined currently-authorized VGU and UP impacts upon and within the MIA.

As described in Section 2.1.5, the Carlton Memorial Reserve Wellfield consists of 16 production wells that withdrawal water from the HAS and the UFA, which will produce a finished water capacity of 7.5 MGD after Phase 1 of the County's EDR unit replacement program is complete. This project identifies additional production and concentrate disposal wells that may be needed to supply the Phase 2 WTP upgrades discussed in Section 2.1.5.4 to produce an additional 7.5 MGD of finished water capacity, yielding a total finished water capacity of 15 MGD.

The Planned Carlton Wellfield Upgrades assumes the following infrastructure for cost estimation:

- Ten new production wells in the HAS, assuming an additional 1 MGD of production each
- Two concentrate disposal wells and monitoring wells
- Miscellaneous piping to interconnect the new system to the existing system.

The estimated total capital cost for the Planned Carlton Wellfield Upgrades is expected to be \$28.7M. Based on the total capital cost amortized over a 30-year useful life at an annual interest rate of 5%, the unit capital cost for the Planned Carlton Wellfield Upgrades is expected to be \$0.68 per 1,000 gallons of finished water. This capital cost does not include the construction cost of \$50M or engineering-related costs that have been procured by Sarasota County for the Carlton WTP Upgrades.

The estimated total annual O&M cost for the Planned Carlton Wellfield Upgrades, which only includes operation of the new production and disposal well systems, is expected to be \$1.2M. Based on the total annual O&M costs, the unit O&M cost for the Planned Carlton Wellfield Upgrades is expected to be \$0.45 per 1,000 gallons of finished water.

The total unit cost for the Planned Carlton Wellfield Upgrades based on capital and O&M costs is expected to be \$1.13 per 1,000 gallons of finished water. Table 4.14 provides a summary of all costs and includes total and unit costs.

Table 4.14 – Planned Carlton Wellfield Upgrades Planning Cost Estimates

Yield (MGD)	Capital Cost (Millions \$)	Capital Cost (\$/1,000 gallons)	Annual O&M Cost (Millions \$)	O&M Cost (\$/1,000 gallons)	Total Cost (\$/1,000 gallons)
7.5	\$28.7	\$0.68	\$1.2	\$0.45	\$1.13

4.5.3 Carlton Regional Expansion Concept

Complimentary to the initial preliminary modeling effort that PWR performed for the Authority as discussed in Section 4.5.2, the Authority requested PWR to undertake additional preliminary modeling to evaluate whether MIA recovery of permitted impacts would still be predicted if the self-relocation of VGU and UP was combined with a 5.0 MGD of withdrawal at Carlton Wellfield from new HAS wells at Carlton. The results of PWR's preliminary modeling of this second scenario continued to predict a substantial degree of MIA recovery. Therefore, the Authority requested PWR to undertake a third analysis to assess whether MIA recovery might still be maintained if the self-relocation of VGU and UP, and 5.0 MGD of new HAS well withdrawals at Carlton Wellfield, were combined with the Peace River RO Facility and Brackish Wellfield project described in Section 4.3.1.4 above. The results of PWR's preliminary modeling of this third scenario again continued to predict a considerable degree of MIA recovery.

Based on these preliminary groundwater flow simulations, there appears to be a significant opportunity to obtain new brackish groundwater quantities within and for the region while still maintaining MIA recovery from the currently-authorized impacts for VGU and UP upon the MIA. The recovery appears to be primarily driven by the discontinuation of currently-authorized UP Wellfield withdrawals from directly within the MIA and self-relocation of these quantities far outside the MIA at Carlton Wellfield.

As referenced above, the foregoing preliminary modeling efforts placed primary focus upon the effects of withdrawals upon the MIA, a primary and vitally important consideration for WUP permitting feasibility. However, other permitting criteria will also need to be evaluated should the foregoing opportunities be further explored. Additional efforts to further explore the County's self-relocation plans and refine the foregoing preliminary modeling efforts is recommended in order to more-definitively determine the technical, financial, environmental and regulatory feasibility of developing new brackish groundwater facilities for the region.

The Authority could develop a 5 MGD groundwater supply at the Carlton Memorial Reserve and develop a similar EDR treatment process at the site. Assuming an EDR performance of 80%, the finished water yield could be 4 MGD. The Carlton Wellfield Expansion Concept assumes the following infrastructure for cost estimation:

- Six new production wells in the HAS, assuming an additional 1 MGD of production each
- Three new EDR units operating at 1.5 MGD finished water capacity each
- One concentrate disposal well and monitoring well
- Miscellaneous piping to interconnect the new system to the existing system.

The estimated total capital cost for the Carlton Regional Expansion Concept is expected to be \$53.4M. Based on the total capital cost amortized over a 30-year useful life at an annual interest rate of 5%, the unit capital cost for the Carlton Regional Expansion Concept is expected to be \$2.38 per 1,000 gallons of finished water.

The estimated total annual O&M cost for the Carlton Regional Expansion Concept is expected to be \$3.5M. Based on the total annual O&M costs, the unit O&M cost for the Carlton Wellfield Expansion Concept is expected to be \$2.36 per 1,000 gallons of finished water.

The total unit cost for the Carlton Regional Expansion Concept based on capital and O&M costs is expected to be \$4.74 per 1,000 gallons of finished water. Table 4.14 provides a summary of all costs and includes total and unit costs.

Table 4.15 – Carlton Regional Expansion Concept Planning Cost Estimates

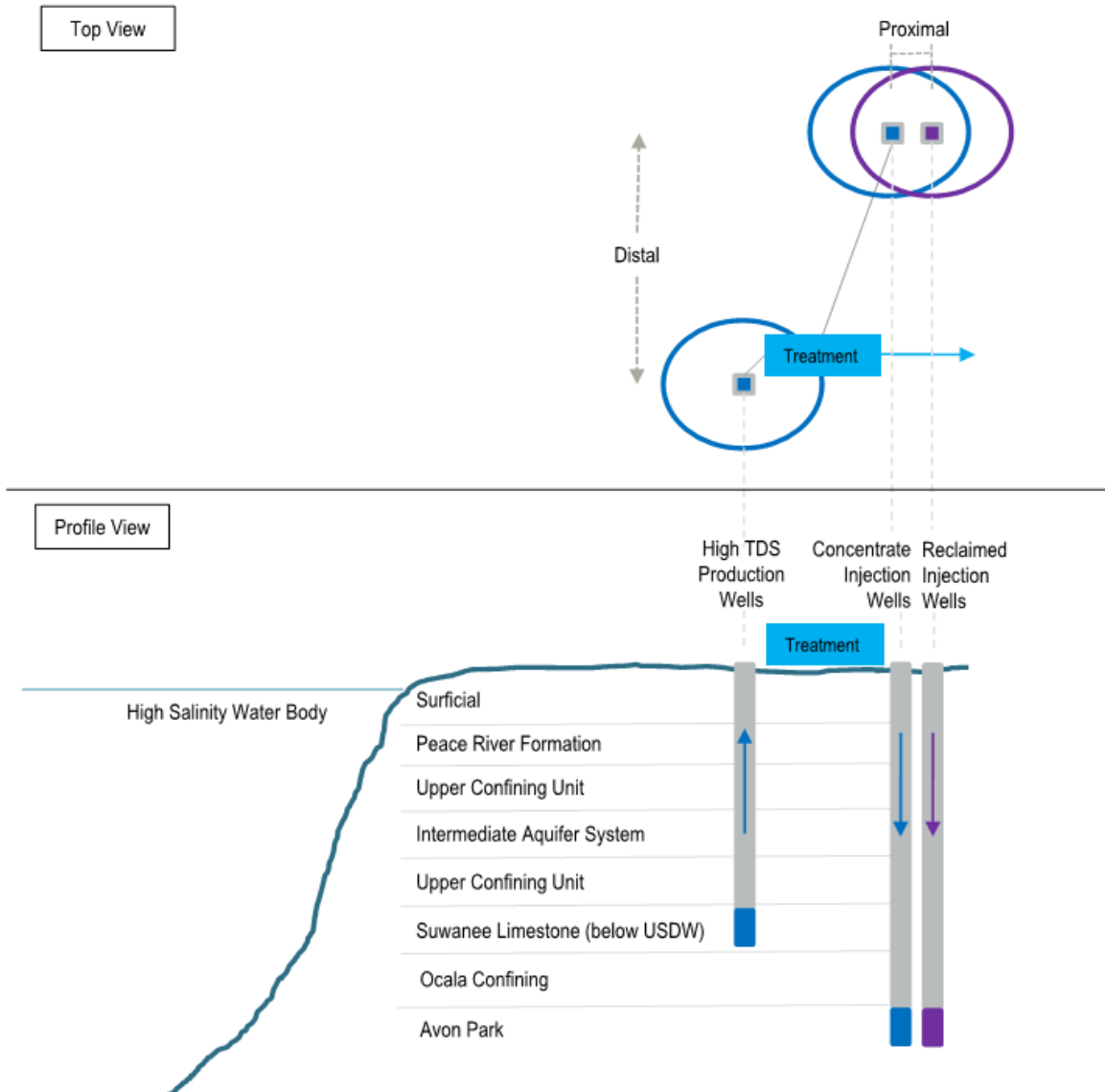
Yield (MGD)	Capital Cost (Millions \$)	Capital Cost (\$/1,000 gallons)	Annual O&M Cost (Millions \$)	O&M Cost (\$/1,000 gallons)	Total Cost (\$/1,000 gallons)
4	\$53.4	\$2.38	\$3.5	\$2.36	\$4.74

4.5.4 High Salinity Groundwater RO Concept

Another option to avoid the potential issues of utilizing high salinity surface water for withdrawal and membrane treatment and concentrate management could be to utilize the aquifer systems. Adjacent to the coast, groundwater can be found within the aquifer systems at concentrations at or above the TDS concentration of 35,000 mg/L for seawater. High salinity groundwater RO may provide several treatment advantages over seawater RO. Wells would greatly reduce screening needs and eliminate the extensive permit requirements of a seawater intake. In addition, groundwater generally has lower turbidity and fouling potential relative to seawater, which may minimize the need for robust pretreatment systems, such as micro- or ultrafiltration. Chemical oxidation and cartridge filters upstream of a groundwater RO membrane system may serve as sufficient pretreatment. Furthermore, brackish/high salinity groundwater water quality conditions may allow for higher flux (less membranes) and recovery rates (lower operating costs), over a seawater system. Utilization of aquifer systems would also minimize the potential costs of wetland mitigation required for impacts to

seagrass and other coastal wetland resources. Figure 4.6 illustrates this concept of high-salinity groundwater RO.

Figure 4.6 - High Salinity Groundwater RO Concept for Western Florida



If concentrate disposal is managed with deep well injection in lieu of surface/seawater discharge, then the need for dilution is significantly reduced or potentially eliminated. Concentrate disposal of a much higher TDS concentration will need to be considered with respect to the deep well injection zone that is selected. Distance between the seawater supply wells and deep injection wells and the geologic horizons selected for withdrawal and disposal should be evaluated so as to not cause the total concentration of the recovered water to increase over time. The evaluation could also consider placing the deep injection well in close proximity to an existing or future reclaimed water or wastewater reject disposal well, which could balance the aquifer salinity injections below the USDW.

The RO concentrate flow rate would be a portion of the groundwater withdrawal flow rate; therefore, coupling high salinity groundwater withdrawal with deep well injection of concentrate would result in a net negative head of the aquifer system closer to the coast. If the seawater withdrawal is conducted in the Upper Floridan aquifer system, this could lead to a potential retreat of the freshwater/saltwater interface back towards the coast surrounding the seawater supply wellfield. Furthermore, continual reclaimed water recharge into the Upper Floridan aquifer system inland of the seawater supply wellfield could accelerate this retreat. Subsurface hydraulic modeling or solute transport modeling coupled with a cost benefit analysis would be needed to determine the seawater wellfield recovery zone, the concentrate disposal system injection zone, the distance between the well systems, and location of the concentrate disposal well system in proximity to existing utilization of the selected zones. Demonstration of a Net Benefit of reclaimed water being recharged for concentrate disposal dilution could provide for the groundwater withdrawals for RO treatment. Securing this Net Benefit, the location of this conceptual system, and the subsurface modeling may ultimately drive the feasibility and the achievable finished water capacity of this system. It is likely that Port Manatee would not be a favorable location for this conceptual system since it is located within the MIA.

No feasibility studies or conceptual site layouts have been performed; however, for cost estimating purposes, the following infrastructure is assumed for a high salinity groundwater desalination facility utilizing the aquifer systems:

- 20 MGD seawater supply wellfield consisting of twenty (20) 8-inch recovery wells completed to the Suwannee Limestone permeable unit
- 10 MGD RO Treatment System with pre-treatment and post-treatment
- 10 MGD RO Concentrate Deep Well Injection System consisting of two (2) 24-inch Deep Injection Wells completed to the AHPZ below the USDW
- 1-mile of 30-inch Diameter RO Concentrate pipeline

Planning level costs were determined for the High Salinity Groundwater RO Concept based on individual estimation of the components described above. The estimated total capital cost for the High Salinity Groundwater RO Concept is expected to be \$173.2M. Based on the total capital cost amortized over a 30-year useful life at an annual interest rate of 5%, the unit capital cost for the High Salinity Groundwater RO Concept is expected to be \$3.09 per 1,000 gallons of treated water.

The estimated total annual O&M cost for the High Salinity Groundwater RO Concept is expected to be \$12.1M. Based on the total annual O&M costs, the unit O&M cost for the High Salinity Groundwater RO Concept is expected to be \$3.32 per 1,000 gallons of treated water.

The total unit cost for the High Salinity Groundwater RO Concept based on capital and O&M costs is expected to be \$6.41 per 1,000 gallons of treated water. Table 4.15 provides a summary of all costs and includes total and unit costs.

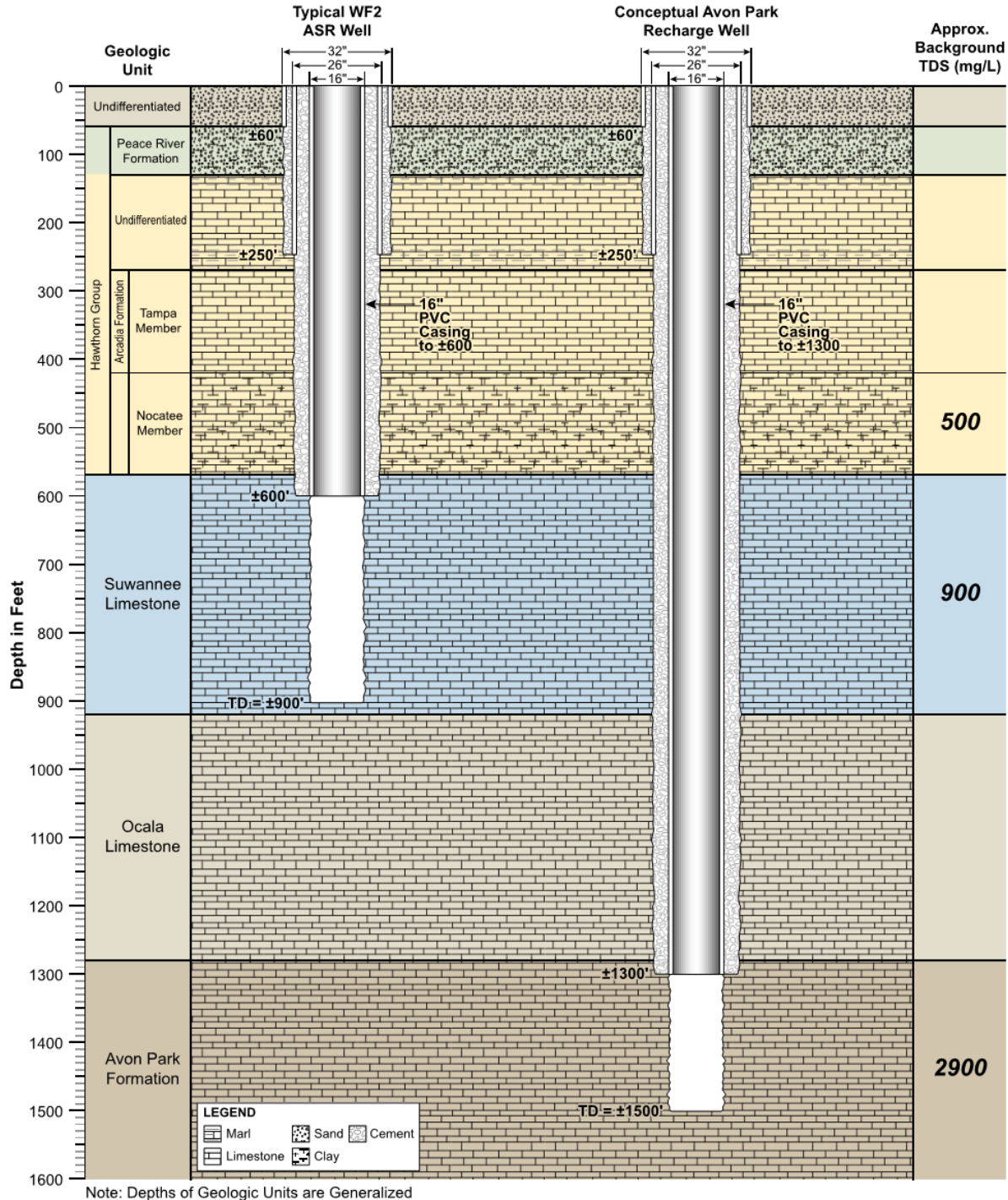
Table 4.16 - High Salinity Groundwater RO Concept Planning Level Cost Estimates

Yield (MGD)	Capital Cost (Millions \$)	Capital Cost (\$/1,000 gallons)	Annual O&M Cost (Millions \$)	O&M Cost (\$/1,000 gallons)	Total Cost (\$/1,000 gallons)
10	\$173.2	\$3.09	\$12.1	\$3.32	\$6.41

4.5.5 Partially Treated Water Aquifer Recharge

To improve water quality (and therefore the recovery efficiency) from the ASR wells, aquifer recharge of PTW beneath the ASR wellfields is a concept that should be considered. The feasibility of implementing this option would require aquifer recharge of PTW to be acceptable to FDEP as the cost of potable water recharge would be too expensive, and the dedication of potable water for aquifer recharge would take up needed treatment capacity at the PRF. Due to an increased head gradient created between the ASR storage zone and the underlying AHPZ created during recovery events, upconing of poor quality water is observed. Installing a PTW Aquifer Recharge well in the permeable zone below the ASR zone (the AHPZ) would displace the brackish native water and provide a protective fresh water barrier beneath the wellfield. This is expected to reduce the rate and magnitude of salinity increases observed during recovery, allow for a greater recovery efficiency from the ASR wells, and result in a more robust and reliable ASR supply when needed. Figure 4.7 provides a construction concept for an Aquifer Recharge well as compared to a typical profile of a WF2 ASR well at the Peace River Facility.

Figure 4.7 - Aquifer Recharge Concept at the Peace River Facility



Aquifer Recharge may be considered an alternative water supply benefit by maintaining water levels in the UFA which is heavily utilized by agriculture in the region. This concept may qualify for SWFWMD cooperative funding and could provide the Authority with an opportunity to obtain new quantities of groundwater through demonstration of a Net Benefit. Since there is minimal treatment expense, the operational cost of recharging excess surface water from the Peace

River during peak flows (that would otherwise be lost to tide) to supplement the UFA could be similar to the operational cost of pumping the excess surface water to an above-ground reservoir system.

The AHPZ is a high capacity aquifer recharge zone that should not be overly susceptible to well plugging due to total suspended solids (TSS) loading in the well. For planning purposes, each recharge well should conservatively provide recharge rates of 5 MGD or greater. One, or possibly two recharge wells are expected to be sufficient beneath each ASR wellfield to fully implement the Aquifer Recharge concept at the PRF. One or more recharge zone monitoring wells per recharge well will also be needed. One AHPZ test ASR well currently exists at the PRF, which could serve as either the initial aquifer recharge test well or as a distal recharge zone monitoring well for a recharge well installed beneath ASR Wellfield No. 2.

Planning level costs were determined for Peace River Facility Aquifer Recharge based on individual estimation of the following components:

- One (1) Avon Park Recharge Well.
- One (1) Avon Park Monitoring Well.
- Piping and Miscellaneous.

The estimated total capital cost and O&M cost as shown in Table 4.16 for the Peace River Facility Aquifer Recharge are expected to be \$3.5M and \$0.07M, respectively.

Table 4.17 - Peace River Facility Aquifer Recharge Planning Level Cost Estimates

Yield (MGD)	Capital Cost (Millions \$)	Capital Cost (\$/1,000 gallons)	Annual O&M Cost (Millions \$)	O&M Cost (\$/1,000 gallons)	Total Cost (\$/1,000 gallons)
0	\$3.5	N/A	\$0.07	N/A	N/A

4.6 Emerging Opportunities to Develop Supply

4.6.1 Indirect Potable Reuse

The SWFWMD's 2015 RWSP reported that within the Southern Planning Region in 2010, utilities were reusing approximately 54% (33.9 MGD) of the 62.7 MGD of available wastewater treatment plant flows at that time. The SWFWMD estimated that reclaimed wastewater was providing an estimated 23.9 MGD of water resource benefits (70% efficiency). The SWFWMD further estimated that by 2035, 70.6 MGD (nearly 80%) of the 80.6 MGD of wastewater that will be produced in the planning region will be beneficially used. Recent analysis for the Authority has indicated that as of



2016, there was a total of approximately 105 MGD of wastewater treatment capacity within the Authority's four-county area of which about 66 MGD was in active use. Of that 66 MGD, approximately 37 MGD (56%) was reported by FDEP to be reused, while about 29 MGD (44%) remained unused. Therefore, there remains ample opportunity to utilize greater quantities of reclaimed water to offset groundwater withdrawals in the region and to secure "New Quantities" of groundwater for public water supply purposes.

The maximum beneficial use of reclaimed water has yet to be achieved in the region. While there are many contributing factors to underutilization of this water supply resource, indirect potable reuse is a strategy for consideration. Further discussion on reclaimed water opportunities and challenges for Florida are located in Appendix B.

For many communities around the globe, potable reuse is a strategy that provides another reliable source alternative for their overall water supply portfolio. For the Authority, implementation of potable reuse could be a strategy to diversify available regional water source types, increase overall regional drinking water supplies, and increase conservation of regional fresh water thereby making the overall water supply portfolio more sustainable. This subsection provides a cursory overview of the regulations, technologies, and approaches related to this concept.

Chapter 62-610.550-575, F.A.C. describes the regulatory requirements for the use of reclaimed water for groundwater recharge and indirect potable reuse (IPR). Groundwater recharge refers to water supply augmentation or the creation of salinity barriers in Class F-I, G-I, or G-II ground waters via rapid-rate land application systems or direct injection. Groundwater recharge also refers to discharge of reclaimed waters which are directly connected to Class F-I, G-I, or G-II ground waters. Class F-I (referring to a specific region within Flagler County) and G-I water refers to ground waters in a single source aquifer that is the only reasonable available source of potable water to a significant segment of the population with a TDS concentration of less than 3,000 mg/L. Class G-II water refers to ground water with a TDS concentration up to 10,000 mg/L.

Within these regulations, IPR refers strictly to discharge of reclaimed water to surface water bodies which are either Class I surface waters or other surface waters which are directly or indirectly connected to Class I surface waters. As with groundwater recharge requirements, more stringent reclaimed water treatment criteria may be placed on discharges to surface water bodies categorized for different uses, which are described in 62-302.400, F.A.C.

The majority of wastewater treatment facilities in the Authority's four-county region are treating to reclaimed water standards or advanced wastewater treatment standards and discharging excess reclaimed water to Class V Recharge Wells, Class I Deep Injection Wells, or to surface water bodies. As stated above, approximately 22 MGD of treated wastewater was estimated to be managed in these fashions. The Authority could partner with their customers to create IPR projects

which would leverage this excess reclaimed water; thereby keeping the overall freshwater supply balance in the region more sustainable.

4.6.1.1 General Conceptual Considerations for Advanced Water Treatment

Though Florida utilities have only recently begun to investigate potable reuse as a drinking water supply alternative, communities in other states have accrued decades of combined experience. These systems are operated under the regulatory guidance/framework directed by their respective states. These regulations build on the USEPA Safe Drinking Water Act, sometimes adding additional monitoring, communication, disinfection, and finished water quality requirements. Therefore, the water treatment requirements, and resulting treatment trains, for IPR systems can vary across the U.S. Many commonalities are still found between these systems. In most IPR systems, highly treated wastewater (nutrient removal, tertiary treatment, etc.) is conveyed to an advanced water treatment plant (AWT), where it is treated to drinking water standards and state regulatory requirements before it is discharged to an engineered environmental buffer (e.g., managed aquifer recharge, reservoir, etc.). The engineered buffer then serves as the source of supply for the drinking water utility. There are dozens of potential configurations for the AWT unit processes; however, many share similar individual elements/technologies. The selection and arrangement of treatment technology is largely driven by utility drivers and regulatory requirement. The following list is intended to be a summary of typical technologies, and is not inclusive of all treatment alternatives:

- **Ozone:** Ozone is a strong oxidant that is leveraged as a disinfectant and to breakdown organic contaminants including taste and odor compounds, trace chemical constituents, and pharmaceuticals. The process uses liquid oxygen (or onsite ozone generation), ozone generators, ozone contactors and gas transfer systems, ozone off gas handling and residual gas destruction system, and controls and monitoring. Ozone is often paired with Biologically Active Filtration in water reuse applications.
- **Biologically Active Filtration:** Biologically Active Filtration (BAF or BAC) used in potable reuse generally consists of a Granular Activated Carbon (GAC) media filters and a layer of biological active community of organisms that populate the media. The microbial community biodegrade contaminants and the BAF can remove turbidity, organic matter, disinfection byproduct precursors, taste and odor compounds, iron, manganese, ammonia, and chemicals such as pharmaceuticals. A major benefit of BAF is that it is a sustainable treatment technology, e.g. minimal chemical/operational inputs and residuals production.
- **Granular Activated Carbon Adsorption:** GAC adsorption is a process that relies on the surface chemistry of organic materials (e.g. coal, wood, lignite, coconut shell, etc.) that have

been activated through pyrolysis process. GAC is effective at removing pharmaceuticals, pesticides, cyanobacteria, tastes, odors, and toxins, and other trace organic contaminants.

- **Membrane Filtration:** Membrane filtration is a generic term for technologies that employ either ceramic or polymeric membrane to filtration. Membrane pore sizes vary based on the technology employed, however pore sizes are grouped into Microfiltration and Ultra Filtration. The smaller pore sizes associated with ultrafiltration can filter some viruses, endocrine disrupters, and contaminants of concern in addition to total suspended solids. Membrane filtration can be provided in flat sheets, outside flowing in tubes, and inside flowing out tubes
- **Reverse Osmosis and Nano Filtration:** Similar to membrane filtration, RO and nano filtration (NF) utilizes a polymeric membrane to filter water. However the pore sizes are small enough to remove particles at the atomic level. As such, RO is often used for desalination or removal of compounds such as ions, pesticides and herbicides. When applied to potable reuse, this barrier is often leveraged to control total dissolved solids and salts within treated wastewater. RO operation generally incurs high power consumption and produces a high concentration brine stream that must be managed.
- **Ultraviolet Light / Advanced Oxidation:** Ultraviolet light (UV) and hydrogen peroxide are often combined treatment technologies (UV/AOP) employed after a filtration step. UV may be implemented as a disinfectant for cryptosporidium, giardia, and virus inactivation. The hydrogen peroxide combined with the UV light generates a hydroxyl radical that can oxidize many chemical constituents that permeate upstream processes.
- **Chlorine Disinfection:** Chlorine is the most common form of disinfection used in water and wastewater treatment. When used in potable reuse, chlorine is often dosed as the final step and prevents biological regrowth in the treated water conveyance system.

A conservative California-standard approach to IPR is following what is known as “Full Advanced Treatment”, or FAT. This treatment train became well known and characterized after implementation at the Orange County Water District’s Ground Water Replenishment System. This treatment process has been studied recently in Florida in Hillsborough County and Clearwater and is currently being studied in Jacksonville and Daytona Beach as well. The overall approach focuses on membrane separation processes and multiple barriers for disinfection. However, due to the high life cycle costs of this approach and the need for brine management, many utilities have moved towards alternative IPR treatment trains that effectively meet their treatment and operational objectives. The foundation of these trains relies on ozone, biofiltration, and GAC, which has been studied recently within Florida in Altamonte Springs. Illustrations of a FAT and an alternative treatment train can be found in Figures 4.8 and 4.9.

Figure 4.8 - Full Advanced Treatment Train

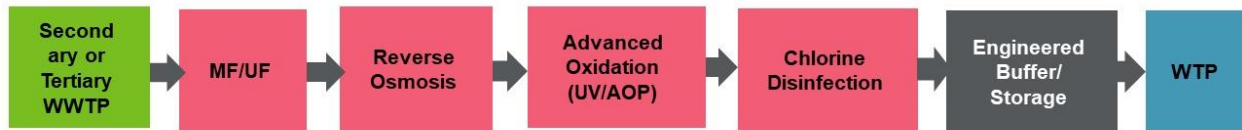
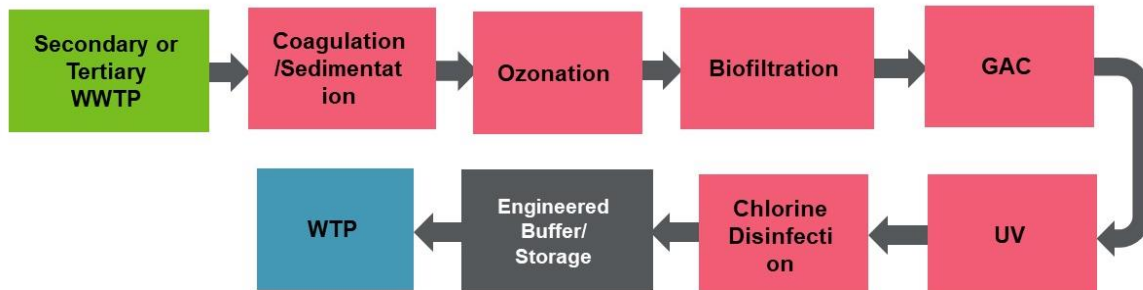


Figure 4.9 - Alternative Non-RO Based Treatment Train



4.6.1.2 IPR Project Example

One approach would be to implement an IPR strategy using managed aquifer recharge. IPR with a groundwater recharge component could be accomplished in several configurations. Reuse water could be recharged into a permeable zone and recovered from the same permeable zone some distance away to allow natural filtration of the water as it moves laterally through the aquifer. Alternatively, reuse water could be recharged into a lower permeable unit (e.g., APHPZ) and recovered from an overlying permeable zone (e.g., Suwannee Limestone). This concept offers not only underground passive and natural treatment as the water migrates through the formation and into the overlying zone, but the fresh reuse water could improve the salinity of the APHPZ and potentially allow better recovery efficiency from the overlying recovery wells. This concept is similar to the Tampa Augmentation Project (TAP) currently being proposed by the City of Tampa.

The TAP is a reclaimed water recharge project designed to provide up to 50 MGD of additional water supply to the City of Tampa during low flow periods in the Hillsborough River, the City's primary source of drinking water. A feasibility study has been completed confirming the feasibility of this concept. Up to 50 MGD of highly treated reclaimed water, water that is currently being discharged to the highly saline Tampa Bay, would be recharged into the APHPZ year-round, with up to 50 MGD recovered from the overlying Suwannee Limestone permeable unit to augment the City's dry season supply. The receiving zone water quality is highly variable, but expected to be in the range of 2,000 to 5,000 mg/L TDS concentration at most recharge well sites. The City is currently working through permitting with FDEP as the regulations are not specifically designed to address unique projects

such as TAP. The City has an existing ASR Ordinance in place to provide institutional control for a portion of the TAP project area, but the ordinance would need to be expanded to include additional area if TAP is permitted and constructed. Recovered water would be returned to either the Hillsborough River Reservoir System or directly into the City's David L. Tippin Water Treatment Plant (DLTWTP). The DLTWTP is designed to remove Total Organic Carbon, color, and other constituents, providing additional barriers to improve drinking water quality. Ozone is the primary disinfection process in place at the DLTWTP. At this time the only additional treatment being proposed is UV disinfection before leaving the wastewater treatment facility and additional UV treatment at individual recharge wellheads. SWFWMD has been a funding partner with the City through the current phase of this project.

4.6.1.3 IPR Development Considerations

The development of IPR concepts for the Authority would require careful planning and consideration to make the concept economically feasible. Primary considerations would include the following:

- Access to reuse water - the physical location of reuse lines/facilities and a willing partner;
- Additional Reclaimed Water Treatment Needs – The regulatory requirements to meet Chapter 62-610.550-575, F.A.C.;
- Location of recharge well and production well system - The regulatory feasibility of a recharge well and a recovery well system is dependent on the site-specific hydrogeology;
- Proximity to the Peace River Facility - conveyance of the recovered water to the Peace River Facility;
- Proximity to the Regional Transmission System - Development of a new recovered water treatment facility and conveyance to Regional Transmission System;
- Public education and outreach;
- Potential changes in Federal funding, the regulatory framework, or guidance through the anticipated USEPA Water Reuse Action Plan (Public Review Goal of September, 2019).

Another important consideration for IPR is the development of partnership agreements with other utilities to reliably provide reclaimed water to the Authority. The intent of these partnerships is to allow the potable supplier to leverage excess reclaimed waters as an additional source supply and maximize the overall beneficial use of the resource. It is recommended that a more detailed IPR evaluation, specific to this system, to evaluate if this alternative water supply approach could be considered as a viable strategy for the Authority.

Florida's Potable Reuse Commission (PRC) has developed a Framework for updating Florida's IPR regulation and implementing new DPR regulation. PRC has used this Framework document to advocate for legislative action. Most recently in the 2020 Legislative Session, Senate Bill 1656 included mandates for FDEP to begin implementing rulemaking for potable reuse by December 31, 2020. This bill was indefinitely postponed and withdrawn from consideration.

4.7 Source Resiliency to Climate Change

The relationship between climate and water is complex, which is understood by entities tasked with making critical decisions about water supply under climate uncertainty. This requires analysis of both water quality and water quantity in order to protect source water to help ensure a sustainable, reliable, and resilient water supply network. Understanding threats to source water is essential to inform decisions about existing and future water sources. These decisions are critical for safeguarding high-quality drinking water for regional water supply. This section considers threats to this region's water supply in the context of natural and anthropogenic influences.

Climate – the prevailing weather for a region – is a contributor to the success of water management, but it can also threaten resilience and hamper reliability. Rising air and water temperatures will lead to water resource challenges and weather extremes – intensifying storms, fluctuating precipitation and droughts, and worsening flood events – and will add complexity to water management decisions. The accompanying rise of sea level threatens the management of water resources and exacerbates salinity intrusion along coastlines. Anthropogenic land use changes throughout the watershed, including agricultural intensification and mining operations, can also affect water supply leading to increased conductivity in source water and decreased water levels.

Today's water management requires us to design and plan for weather uncertainty. This 21st century challenge necessitates innovation not only at the water source – water quality and quantity – but also warrants planning that identifies vulnerabilities and looks at opportunities to adapt. The resiliency of system components must also be considered, including raw water collection and intake equipment, treatment facilities, and storage and distribution facilities, as well electronic components and automated systems. When talking about water supply vulnerabilities, building in redundancy and flexibility to manage, store and deliver sufficient supplies of water at the right time and to the right place throughout the year is critical.

As the climate becomes increasingly unpredictable, forecasting climate hazards is expected to complicate management of regional water resources. Addressing climate vulnerabilities for southwest Florida will be essential for reducing risk and informing decisions to ensure resilience, particularly as they relate to long-term sustainability and reliability of water supplies. Potential climate stressors addressed herein include:

- Sea level rise (SLR)
- Storm surge
- Extreme heat
- Extreme precipitation and rainfall patterns
- Extended drought

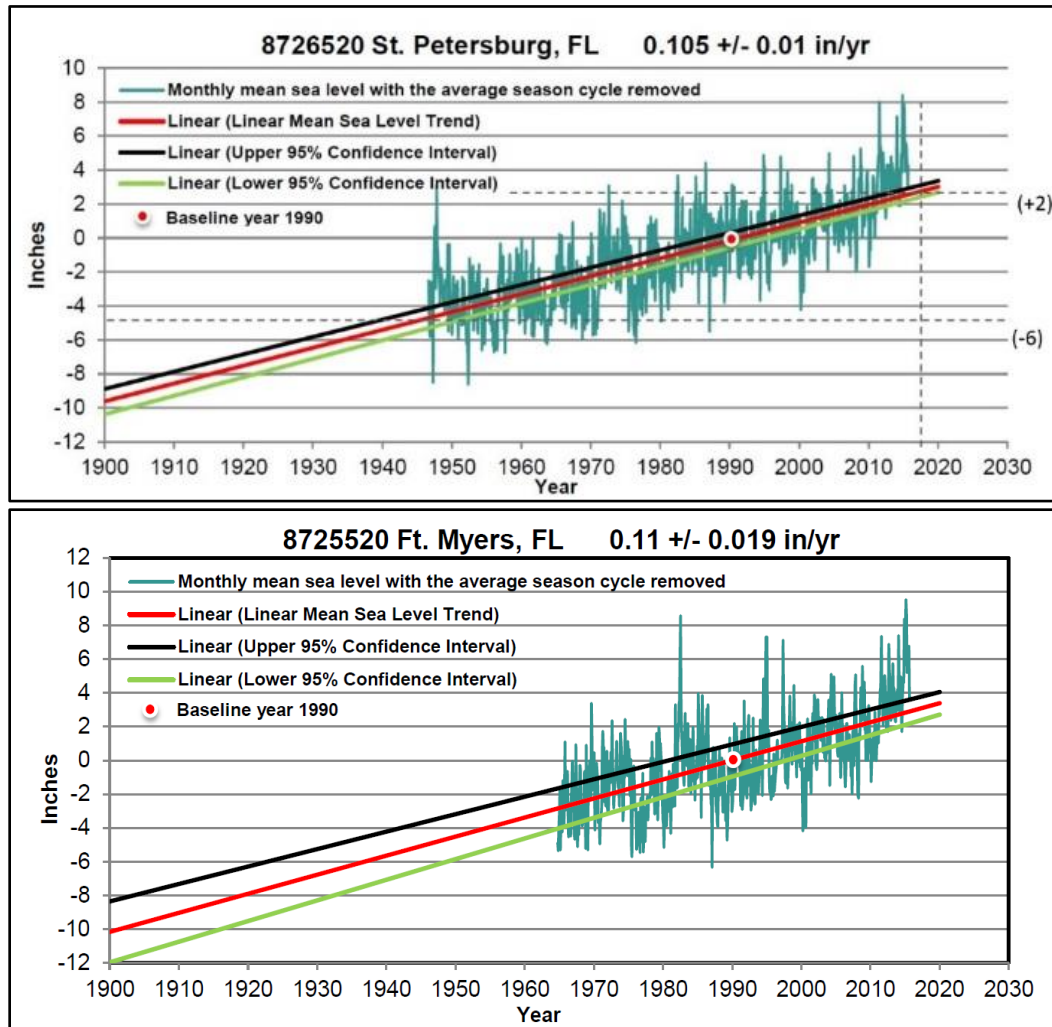
4.7.1 Sea Level Rise and the Potential Influence on Source Water

The PRF lies within the East Gulf Coastal Plain which is geographically defined by low elevation topography with thousands of miles of shorelines interconnected by tidal inlets, bays, creeks, and rivers. The Peace River Diversion Pump Station intake structure is located along the tidal reach of the Peace River. While the location of the intake structure is upstream in the Peace River enough to seldom observe salinity values beyond the treatment capabilities of the PRF, it is vulnerable to sea level rise, as well as tidal storm surge. Moreover, sea level rise is causing the salinity value exceedances above the TDS secondary drinking water standard to become more frequent. Other water quality threats associated with extreme heat, extreme rainfall, and anthropogenic influences such as agriculture and mining also warrant consideration.

4.7.1.1 Sea Level Overview

Sea levels along the Florida coast have risen steadily, as recorded by National Oceanic Atmospheric Administration (NOAA) tide gauges in St. Petersburg and Ft. Myers, Florida (Figure 4.10). Based on recorded tidal data from these gauges, the southwest Florida region has experienced over seven inches of sea level rise since 1947 of which over 2 inches of rise occurred between 1990 and 2015. Analysis of the gauge data indicates an average annual rise in sea level between 0.10 inch/year and 0.11 inch/year. Climate projections suggest that this trend will continue across the region.

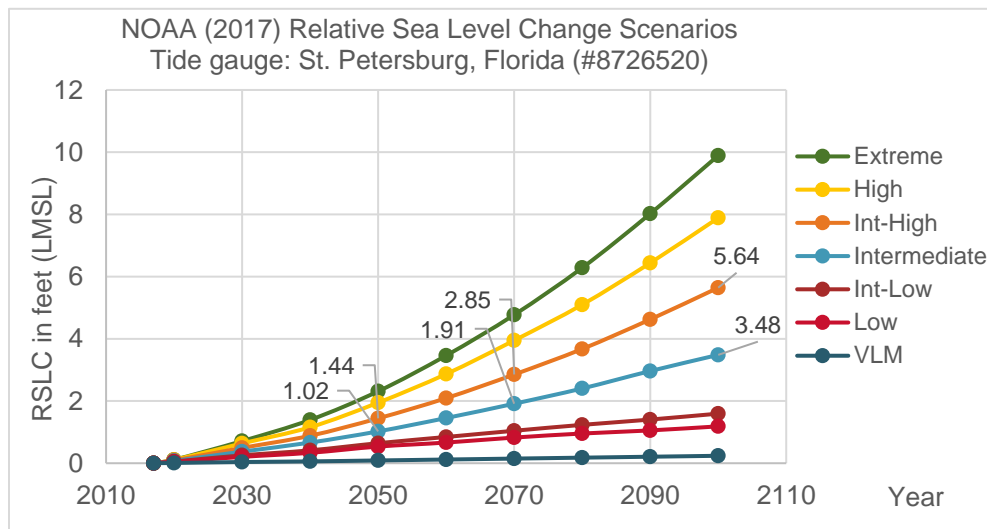
Figure 4.10 - Mean Seal Level Trend for St. Petersburg and Ft. Myers Tide Gauges



Source: National Oceanic Atmospheric Administration (NOAA)

The NOAA Office for Coastal Management has used recorded data to forecast future sea level rise (NOAA, 2017). The NOAA projections shown in Figure 4.11 incorporate local and regional phenomenon such as increasing water temperature, land subsidence, wind and currents, and aquifer withdrawals. These projections incorporate data from the 2014 International Panel on Climate Change (IPCC) and include the latest observational science for the loss of Antarctica's glaciers. These 2017 projections differ from earlier projections in that they revise the lower bound of sea level rise using updated tide gauge and altimeter-based sea level estimates that show an increased rate of sea level rise. The new projections also contrast future carbon dioxide (CO₂) emission scenarios. Using these NOAA projections (2017), southwest Florida could experience an 8 inch (intermediate) to 11 inch (intermediate high) rise in sea level by 2040 and between 1.9 feet and 2.9 feet by 2070.

Figure 4.11 - NOAA (2017) Relative Sea Level Change Scenarios



Saltwater intrusion, when coupled with sea level rise, will move the coastal freshwater – saltwater interface inland. Saltwater intrusion is accelerated by fresh/brackish aquifer drawdown inland of the interface, yet it can be reversed if aquifer recharge provides a sufficient piezometric head differential to overcome the saltwater. At the surface, pressure from rising sea levels coupled with storm surge events could transport saltwater further inland into freshwater canals, creeks, and rivers. The Authority has monitored conductivity and river flows at their River Diversion Pump Station for decades and have conducted studies to understand how saltwater migration inland at the surface could impact the length of time that they can harvest desirable water from the Peace River for storage and treatment.

4.7.1.2 Sea Level Modeling

To better understand how sea level rise and other climatic hazards could affect regional water supply, the Authority developed a scientific model to analyze inter-relationships between distinct decision making parameters, including precipitation, temperature, sea level, drought, and salinity. SUMDAT (System Utility Management Decision Analysis Tool) is a system reliability model that allows the user to analyze up to 20 input variables along 40 years of daily hydrologic sequence data for three streams to project water quantity and quality outputs. SUMDAT includes five sea level rise scenarios (USACE, 2014) ranging from current levels to an increase of 24-inches at the Peace River intake structure.

Based on this model, the current reliability for the Peace River Water Treatment Facility is projected to be 99.5% for quantity and 96.5% for quality. As the Authority advances their planning for a third Reservoir and expanded ASR system, this model should be updated to consider sea level rise greater than 24-inches and run to refine the overall reservoir size and quantity of additional ASR

wells needed to achieve appropriate reliability for finished water quantity and quality for future demands.

4.7.2 Storm Surge

Storm surge occurs due to an abnormal rise in tidal water generated by a passing storm, which can cause flooding along coastlines, as well as inland through waterways. Surge water combines with the astronomical tide and wind to create a storm tide. A warmer atmosphere will lead to warmer ocean temperatures, and warmer ocean temperatures would be expected to fuel tropical storms. Storms and surges would be expected to worsen in terms of frequency and intensity as oceans warm and sea levels rise. Storm surge events that push saltwater inland will threaten surface water sources and have the potential to inundate vulnerable infrastructure.

The two existing Authority reservoirs are vital components to the Authority being able to store excess freshwater from the Peace River so that there is available surface water to treat and distribute to its customers during times that the Peace River surface water quality is not sufficient to meet primary and secondary drinking water standards after treatment at the PRF. Reservoir No. 1 is an in-ground reservoir with the side wall meeting the adjacent ground elevation of approximately 32 feet Mean High Water (MHW) (NAVD 88) and has an overflow canal that can convey excess water from the reservoir back to the river by a gravity-flow canal. Reservoir No. 2 is an above-ground reservoir that is inland and adjacent to Reservoir No. 1. Reservoir No. 2's top of berm elevation is 72.5 feet NAVD88. The planned Reservoir 3 in the Authority's current CIP and discussed in Section 4.3.1.4 above will need to consider ground elevations with regard to this potential vulnerability.

The Authority's existing ASR System provides additional off-stream storage of water that can be recovered for treatment during times of need. Wellfield 1 consists of 9 wells which are spaced out around the PRF Site between Kings Highway and the Peace River. Wellfield 2 consists of 12 wells which are located adjacent to the south side of Reservoir No. 1. Each ASR Well contains a recovery pump with motor, pressure instrumentation, flow metering, and an automatic valve that can be operated through SCADA. The power to equipment are supported by above-ground electrical panels and transformers. The Authority should consider evaluating this equipment for the vulnerability to tidal storm surge of extreme weather events.

4.7.3 Temperature

Average annual air temperatures have increased in southwest Florida by around 2.2° F over the past 50 years, as estimated from a meteorological station east of Bradenton, Florida (Florida Climate Center). Projections for southwest Florida suggest air temperature maximums and minimums could increase by 3.6°F – 5.4°F by 2050 (Climate Adaptation Plan, 2018).

As air temperatures rise, surface waters absorb heat. According to the EPA, global average sea surface temperatures (SST) have increased from a low in 1910 to 2015 levels, which are 2.6°F warmer. By 2050, Atlantic and Gulf of Mexico SST are expected to increase at least 1.3°F more, but could rise as much as 4°F or 5°F (Climate Adaptation Plan, 2018). Increasing air temperatures will likely continue to increase water temperatures resulting in a reduction of surface water quality. Surface water temperatures would be expected to increase within regional waters.

Harmful algal blooms (HAB), both freshwater (e.g. some cyanobacteria) and marine (e.g. “red tide”) toxic algal species, would be expected to benefit from warmer temperatures. In fact, some HABs are believed to have a competitive advantage under warmer air and water temperatures (EPA, 2013), and warmer waters could enable HABs to persist year-round thereby decreasing surface water quality.

4.7.4 Precipitation

Precipitation influences water supply through changing rainfall patterns, which has implications for water quality and quantity, as well as through extreme precipitation events that can cause inland flooding that affects water quality. The Florida wet-season is typically characterized as roughly occurring May through October and the dry season November through April. Florida weather is known for both seasonal patterns and interannual variability in precipitation with distinct periods of drought and extreme rainfall influenced by local, regional, and global climatic factors, such as summer thunderstorm activity and tropical cyclones, winter frontal systems, sea breeze convection, and El Niño / La Niña events (Climate Adaptation Plan, 2018).

Higher air temperatures would be expected to increase the likelihood of extreme precipitation events. Warmer air can hold (and release) more moisture than cooler air, which explains part of the reason why rainfall intensities will likely increase as the atmosphere warms. Projections suggest an increase in precipitation in the southeastern U.S., but overall distribution of rainfall will vary with some regions expected to decrease (NASA, 2016).

A review of literature on rainfall suggests that seasonal precipitation patterns could be shifting in Florida. A study analyzing Florida rainfall suggested possible changes in the onset of wet season precipitation (i.e. drier May) leading to an overall decrease in wet season precipitation (Irizarry-Ortiz, *et al.*, 2013). At the same time, the study suggested a possible increase in the number of rainy days during the dry season (i.e. especially during November, December, and January). A delayed onset of the rainy season during May could result in a greater incidence of localized drought episodes, which when combined with higher temperatures, could result in reduced water supply and reduced water quality in surficial waters.

Seasonal rainfall directly influences watershed hydrology and surface flows. Early in the summer wet-season, much of the rain that falls diverts to surface and ground water storage. Towards the end of the summer wet-season when soils become saturated and surface waters full, rainfall begins to increasingly contribute to surface water runoff, which can lead to substantial increases in surface flows and a reduction in water quality. Extreme rainfall events can also flush nutrient-laden runoff to surface waters, which in turn can trigger and fuel HABs.

Precipitation patterns are expected to remain unpredictable until the accuracy of climate models improve, which has implications for water management decisions such as predicting river flows, computing evapotranspiration, and recharging ground water. Extreme precipitation events will also impact water quality, as well as protection of infrastructure delivery (pipes) and processing.

4.7.5 Drought

Although the western region of Florida receives about 53 inches of rain annually (Florida Climate Center), it can and does experience drought. Even with Florida's high annual rainfall, the effects of drought can be long-lasting and far-reaching and can have severe consequences. During the dry season and extended periods of drought, water demand increases, which adds pressure to water supply. Surface water levels diminish more rapidly during warmer months due to evapotranspiration and when coupled with drought conditions, this can lead to utility water shortages. Groundwater withdrawals also increase and become strained. As desirable water quantities diminish in surface waters and aquifers, water quality can suffer and water supply in coastal regions can be exposed to elevated salinity concentrations.

4.7.6 Anthropogenic Impacts

Previously considered factors with the potential to negatively impact future surface water resources included agriculture, phosphate mining, and urban development. These factors will remain a concern for the foreseeable future, particularly during the dry-season and under low-flow conditions when water quantity and quality can be adversely affected.

Agricultural lands are increasingly converted to residential suburban land uses. Urban development has increased impervious surface areas and storm water runoff, and the loss of pervious areas have seasonally altered the hydroperiod of surface waters. The increase in population will result in the need for additional water supplies but will also result in more wastewater that can be treated to reclaimed water standards for beneficial reuse. Land use transitions as discussed in Appendix B of this report for these conversions can also be quantified in applying for a permit to withdraw water at another location in a manner that provides a Net Benefit. The increase in population and limited traditional water supplies is the impetus for finding ways to use reclaimed water as a water resource.

Ground water withdrawals within the region have resulted in saltwater intrusion. One strategy to mitigate the impacts of over withdrawal from the UFA include groundwater recharge as stated in Section 4.5.1 and 4.5.3 above. The recharge of reclaimed water or excess storm water can offset water level impacts and reduce, slow, or even recede saltwater intrusion in the aquifer. These projects are underway in member Counties including Manatee County and Sarasota County aquifer recharge with reclaimed water, as well as to the north in Hillsborough County. SWFWMD has implemented an aquifer recharge project using excess water at Flatford swamp to mitigate reduced water levels in the MIA and to return the swamp to its natural hydroperiod prior to agriculture development in the area.

4.7.7 Source Water Vulnerability Assessment

A conversation about a sustainable, reliable, and resilient water supply network must include a general understanding of vulnerabilities within the region including those associated with the potable water supply sources.

4.7.7.1 Peace River Manasota Regional Water Supply Authority

The Authority's source water is solely the Peace River, which includes the infrastructure to retrieve, store, and treat water – e.g. River Diversion Pump Station, Peace River Facility, inland reservoirs, ASR system, internal road network, transmission pipelines, and transmission buildings.

Sea level rise and tidal storm surge could impact the River Diversion Pump Station motors (18 feet above Irma flood level) along the Peace River under future extreme climate scenarios. Currently, tidal flooding occurs periodically. Tidal storm surge was observed at this location as Hurricane Irma passed in September 2017 and tidal waters flooded 7 feet above MHW, inundating a large portion of the access roadway and nearly inundating the pump station's wet well slab. Salinity would also be expected to increase as sea levels push the freshwater interface further up the Peace River.

Future expansion of the River Diversion Pump Station and possible siting further upstream as discussed in Section 4.3.1.3 could begin to mitigate these vulnerabilities. Relocating the new intake pumps further upstream could also provide added resiliency from potential fuel spills along SW CR761.

Reservoir No. 1 (32 feet above MHW) could become vulnerable to tidal storm surge during extreme storms and under future sea level rise scenarios. Should Reservoir No. 1 become filled with higher conductivity water than is treatable by the PRF, Reservoir No. 2 has a direct connection to the PRF that can be used to bypass Reservoir No. 1. Reservoir No. 1 would need to be slowly blended with Reservoir No. 2 water at the PRF and supplemented with fresh water from Reservoir No. 2 or the ASR system at the same time until the normal operation of the reservoir system could resume.

Construction of a third reservoir inland of Reservoirs 1 and 2 would add redundancy to buffer the water supply from these types of vulnerabilities to extreme climate events.

Extreme precipitation and changing rainfall patterns add unpredictability to managing water supply. Extended droughts, such as the extended drought conditions experienced in 2001, coupled with higher temperatures can impact water quality. Additionally, upstream within the Peace River watershed, surface water quantities during lower flows would be expected to continue to be reduced by agricultural intensification, phosphate mining, and urban development. The Authority will continue to explore new source water possibilities. The Authority's SUMDAT modeling has recently shown that implementing source rotation management techniques between reservoir withdrawals and ASR system withdrawals can increase water supply reliability.

Other known natural hazards that may increase in frequency and/or intensity under future climate change scenarios include episodes with extreme wind and saturating rainfall that can disrupt the electrical grid and damage pipeline infrastructure, as well as increased wildfire potential during periods of drought. As these assets are upgrade or replaced, extreme climate events should be systematically addressed to add resiliency and avoid future damage. In accordance with the 2019 update to the America's Water Infrastructure Act, the Authority will be performing risk assessments on environmental hazards and malevolent acts and will address the vulnerabilities discovered.

4.7.7.2 Charlotte County Source Water

The source water for Charlotte County includes interconnections to the Authority's PRF and brackish groundwater. The vulnerabilities of the associated infrastructure (e.g. distribution pipes, electrical grid, tanks), as well as the existing wellfield and the Burnt Store RO facility should be reviewed in the context of natural climate hazards such as saltwater intrusion into groundwater, storm surge at the facility, and/or extreme winds and saturating rains that could impact the electrical grid and pipeline distribution.

4.7.7.3 DeSoto County Source Water

The source water for DeSoto County includes interconnections to the Authority's PRF and brackish groundwater. Adaptation measures taken by the Authority to reduce source water vulnerabilities would benefit DeSoto County.

4.7.7.4 Manatee County Source Water

The source water for Manatee County includes the Lake Manatee Reservoir, groundwater, and ASR wells. The water treatment plant and associated infrastructure is located landward of the Reservoir along the Manatee River and sits upstream of the Lake Manatee Dam on elevated ground between 50 and 56 feet (Google Earth). The top of the reservoir's spillway gates are at approximately 43 ft in



elevation above MSL. Based on sea level rise projections (NOAA 2017, Intermediate/Int. High), tidal waters would be expected to increase downstream of spillway gates in the short-term.

4.7.7.5 Sarasota County Source Water

The source water for Sarasota County includes interconnections to the Authority's PRF, supply from Manatee County, and groundwater. Adaptation measures taken by the Authority to reduce source water vulnerabilities will benefit Sarasota County. Sea level rise projections show increase into Curry Creek, Blackburn Canal and Hatchett Creek in the near-term. Sea level rise projections also extend past the Carlton wellfield along Myakka River by 2050 and up to Shiney Town by 2100. The Carlton water treatment plant could be susceptible to a Category 4 storm surge event depending on storm approach; however, existing natural barriers will help buffer the facility. Ground water withdrawals and extreme periodic drought conditions within the region could increase salinity levels in groundwater withdrawals at the Carlton wellfield due to saltwater intrusion, although the Carlton WTP is prepared for brackish water treatment with EDR units. As discussed in Sections 4.5.1 and 4.5.4 above, one strategy to mitigate saltwater intrusion associated with over withdrawal from the UFA could include aquifer recharge.

4.7.7.6 City of North Port Source Water

The source water for the City of North Port includes interconnections to the Authority's PRF, ground water, and Myakkahatchee Creek and the Cocoplum Waterway. Infrastructure includes the Myakkahatchee Creek water treatment facility and the two in-water control structures that serve as salinity barriers, as well as the future West Villages water treatment facility and wellfield. Water quality in Myakkahatchee Creek degrades during periods with low rainfall, which limits water withdrawals. The water quality in the Cocoplum Waterway is relatively worse, but withdrawal limitations are not established for that waterway. According to Sarasota County LiDAR and Digital Elevation Model (DEM) data (2007), the Myakkahatchee Creek facility sits between elevations 8 and 12 feet NAVD88. Given the location between the two waterways, the facility could experience increased vulnerability to tidal storm surge, particularly as sea levels rise. Sea level rise will push tidal water up Myakkahatchee Creek past the wellfield toward Warm Mineral Springs and north of US41 along Big Slough.

4.7.7.7 City of Punta Gorda

The source water for the City of Punta Gorda includes interconnections to the Authority's PRF, the Shell Creek Reservoir, and brackish groundwater wells. The Shell Creek Reservoir was created by the impoundment of Shell and Prairie Creeks by the Hendrickson Dam. The Shell Creek WTP on Washington Loop Road is elevated between 18 and 22 feet (Google Earth), but could experience vulnerability to tidal storm surge as sea levels increase downstream of the Hendrickson Dam, which

serves as a salinity barrier across Shell Creek. Similar considerations could be needed at the Punta Gorda Isles facilities.

4.7.8 Source Resiliency Recommendations

The following recommendations include short and long-term actions to consider in conjunction with planning and coordination between the member/local governments and the SWFWMD. These recommendations are intended to enhance protection of source water and distribution networks and to promote continued reliability of the regional water resources into the foreseeable future. These recommendations focus on natural hazards and, for the purposes of this section, assume that current regulations will help protect the PRF from the potential anthropogenic hazards briefly discussed above.

- Diversify the source water portfolio to ensure a redundant, reliable, and resilient water supply network;
- Consider rotational supply management, which can benefit from a diversified portfolio and can create excess yield to increase reliability in times of uncertainty;
- Update the SUMDAT with new SLR projections and other regional parameters;
- Install storm surge barriers to protect Reservoir No. 1 from receiving river water via the overflow canal;
- Design considerations for a third reservoir should include berms above the operating water level above the storm surge elevation to buffer the water supply from vulnerabilities to extreme climate events. Evaluate the size of the future reservoir with consideration of climate vulnerability impacts discussed above;
- Expand ASR wellfield if partially treated water ASR becomes implementable to provide more storage options and redundancy to surface water storage;
- Assess the viability of expanding the River Diversion Pump Station further upstream to reduce the frequency of salinity encroachment and add resiliency from potential fuel spills along SW CR761.

5 Regional Transmission System

5.1 Background

“Through cooperation and collaboration the Authority and its Members shall create, maintain and expand a sustainable interconnected regional water supply system”. This is the vision statement in the Authority’s Strategic Plan. Consistent with that regional Vision the Authority has continually planned and constructed regional transmission pipelines that provide water to meet their Customers’ growing water demands and improve resiliency in the regional water supply system. In 2006, the Authority completed a Regional Integrated Loop System Feasibility/Routing Study (PBS&J, January 2007) which identified a transmission network that would interconnect individual water systems with regional supplies in the Authority’s service area. Since then, the Authority has completed construction of 25 miles of regional pipeline, with 11 more miles in construction now. Planning continues for the remaining transmission pipelines required to complete the Authority’s regional vision. Figure 5.1 provides an overview of the current, planned, and proposed pipelines with transmission main delivery points and current and future water treatment facilities in the region that are discussed in this report section.

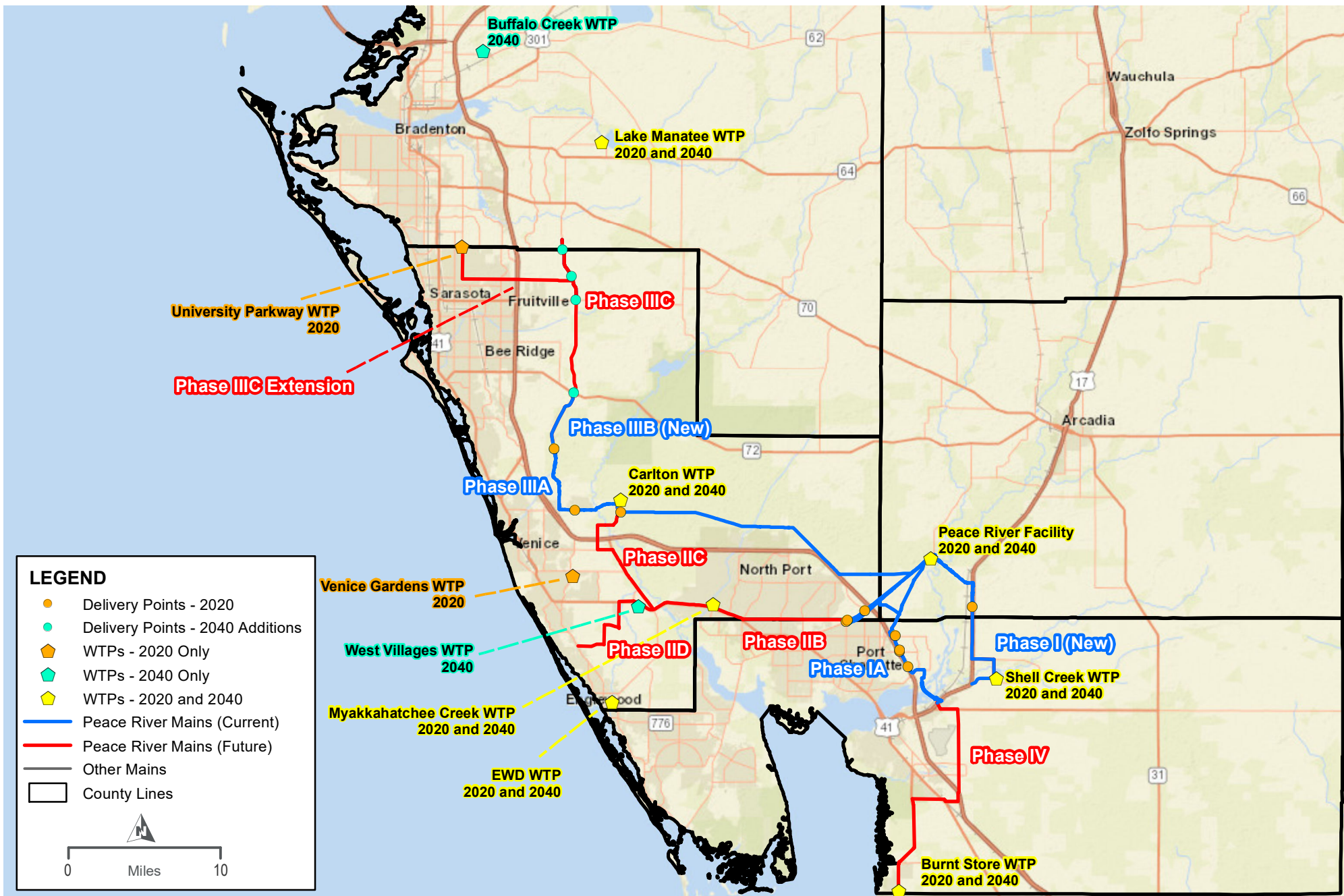


FIGURE 5.1 - EXISTING/FUTURE REGIONAL TRANSMISSION SYSTEM

Annually, the Authority updates their Capital Needs Assessment (CNA) which includes projects to be initiated within 5 years and Capital Improvements Plan (CIP) which includes projects to be initiated within 20 years. The planned regional transmission mains are summarized in Table 5.1 below.

Table 5.1 - Planned Regional Transmission Mains

Pipeline	Length (Miles)	Nominal Diameter (Inches)	Current Planned Route Start and Stop	Status
Phase I	7	24"	US17 @ Enterprise to Punta Gorda Shell Creek WTP	In Construction - Complete in 2020
Phase IIB	10	36"/42"	Charlotte County line near Serris Boulevard to North Port Myakkahatchee Creek WTP and Bachman Regional Pumping and Storage Facility	In 2020 CIP to be complete in 2026
Phase IIC	14	36"	North Port Myakkahatchee Creek WTP to Sarasota County Carlton WTP	In 2020 CNA to be complete 2036
Phase IID	12.5	24"	North Port Myakkahatchee Creek WTP to EWD's System at Keyway Road and S.R. 776	In 2020 CNA to be complete 2039
Phase IIIB	5	48"	Preymore/SR681 Interconnect to Clark Road	In Construction - Complete in 2021
Phase IIIC	6.5	36"	Clark Road to University Avenue	In 2020 CNA to be complete in 2029
Phase IIID	3.5	24"	Fruitville Road to University Parkway	Converted to local line. Completed by Sarasota County
Phase IV	15	24"	Burnt Store WTP to Phase IA Pipeline near Ridge Road and Highway 17	In 2020 CNA to be complete in 2040

The Phase IA, Phase IIA, and Phase IIIA pipelines are constructed and in use, and Phase 1 and Phase 3B are under construction. The Authority's previously planned Phase IIID pipeline was constructed by a private entity and conveyed to Sarasota County as part of the local distribution system in 2017. The Phase I and Phase IIIB Pipelines are currently under construction. Since the 2015 Plan, efforts have been undertaken provide improved understanding of the regional water supply system's capability to deliver water to the Authority's Customers in the event that a major water treatment facility goes offline or regional transmission main fails. An initial desktop evaluation was performed, and protocols were developed for procedures to individually bypass seven water treatment facilities and eight regional transmission mains. These protocols are documented in the SOP for Regional Water Supply System Emergency Operation (HDR, December 2018) and located in Appendix C.

5.2 Regional Hydraulic Modeling Summary

As part of this 2020 Plan, a regional hydraulic model was developed to further understand hydraulic restrictions and regional interdependencies of the transmission and distribution system network.



Hydraulic models of existing systems were collected from Charlotte County, City of North Port, DeSoto County, Manatee County, City of Punta Gorda, and Sarasota County, where they were combined with the existing Authority transmission system model utilizing Bentley WaterGEMS in order to create a master model for the entire regional system. All individual hydraulic models were assumed to be calibrated for their distribution systems with respect to spatial pressure and demands. This Master Model was validated and refined in order to represent the regional transmission and distribution system as a whole. The final Master Model includes all constituent utility systems in their entirety as received and was used for capacity evaluation of the Authority's current and proposed future transmission mains, pump stations, and interconnects. This capacity evaluation included identification of the need for various pipe segments and the simulation of alternative pipe segments than currently planned as needed. The Master Model was also used to evaluate the regional transmission and distribution system potential to meet demands in emergency scenarios (i.e. a water treatment plant going offline or a transmission main failure). Detail in the Master Model development, assumptions, and modeling scenarios can be found in Appendix D.

5.2.1 Flow and Pressure Hydraulic Modeling – Normal Conditions

The Master Model was used for validation of current and future Authority regional transmission mains for five demand scenarios as follows:

- 2020 AAD Demands to verify flows to Authority Customers as determined in the MWSC – Amendment 2 are met
- 2020 Annual Maximum Day Demands (MDD) to verify flows to Authority Customers as determined in the MWSC – Amendment 2 are met
- 2040 AAD to simulate the ability to meet future demand quantities identified in Appendix A – Demand Projection Update; Section 2.2 “Latest Customer 2018 Demand Projections”
- 2040 MDD to simulate the ability to meet 2040 AAD with a peaking factor of 1.4, as determined in Section 3.4
- 2070 MDD to simulate the current, planned, and proposed transmission system velocities and adjust planned or proposed transmission system sizes or add parallel pipelines as needed

Table 5.2 provides a summary of these flow and pressure hydraulic modeling criteria.

Table 5.2 - Authority Master Hydraulic Model Demands – Normal Conditions

Member, Customer, or Partner	Contracted Pressures (psi)	2020 (Contracted)		2040 (Projected)		2070 (Projected)
		AAD (MGD)	MDD (MGD)	AAD (MGD)	MDD (MGD)	MDD (MGD)
Charlotte County	65	16.100	22.540	17.530	24.542	40.575
DeSoto County	65	0.675	0.945	1.400	1.960	3.240

Manatee County	-- ¹	0.000	0.000	55.750	78.050	129.039
Sarasota County	20/65 ²	15.060	21.084	29.700	41.580	68.744
City of North Port	65	2.855	4.011	10.760	15.064	24.905
City of Punta Gorda	-- ¹	1.000 (Optional)	1.400 (Optional)	5.054	7.076	8.618
Englewood Water District	-- ¹	0.000	0.000	3.190	4.466	5.845

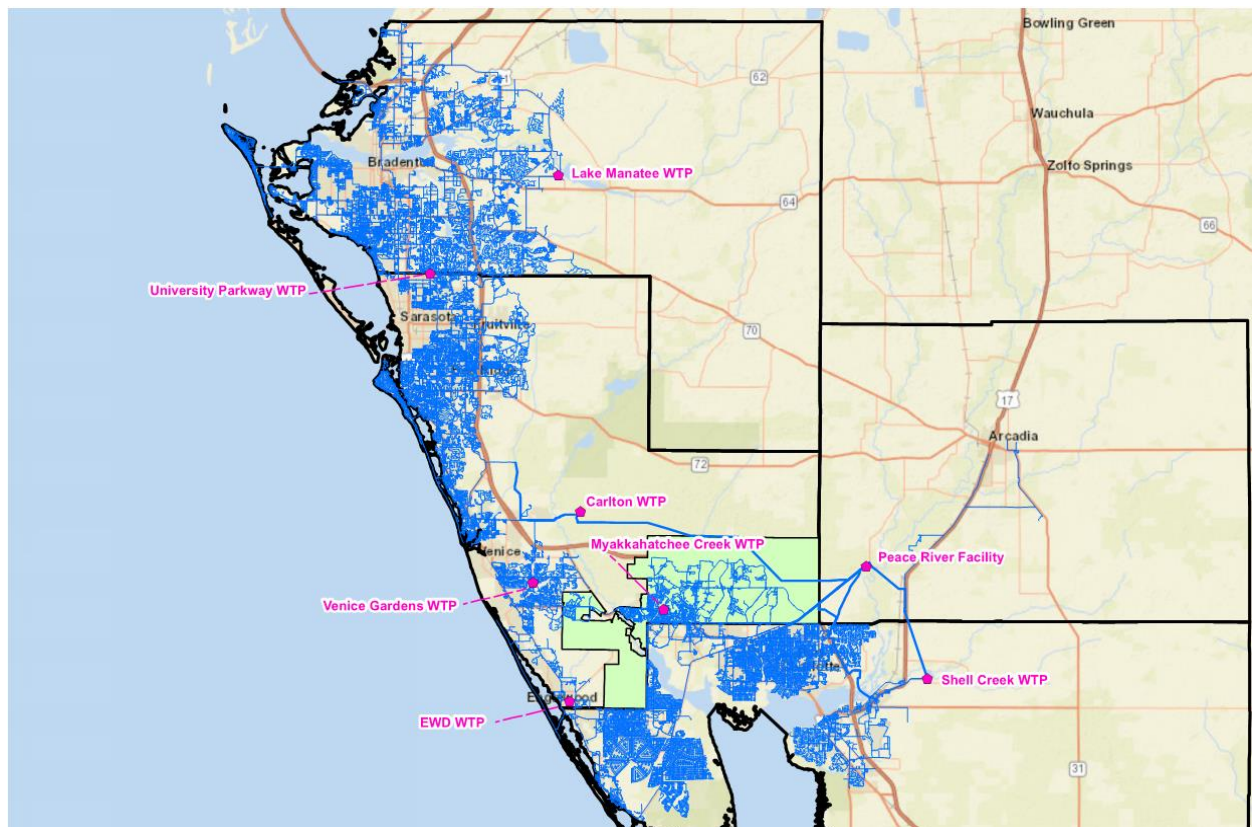
Notes:

¹ Where no pressure was contracted, a pressure above 40 psi is assumed to be sufficient

² Contracted pressure for delivery to the Carlton WTP is 20 psi. Contracted pressure for the Phase 3A Interconnect is 65 psi.

The 2020 active piping and treatment plant infrastructure from the Master Model are shown in Figure 5.2.

Figure 5.2 - Master Model 2020 Infrastructure



Finished water capacities from all treatment facilities were assumed to be consistent with the AAD and peak finished water yields documented in Section 2 of this report for 2020 and permitted 2040 conditions.

To assess the system, the following criteria were generally considered to be triggers for evaluation during 2020 and 2040 scenarios: velocities above 4 ft/s in transmission mains, pressures below 40 psi in distribution systems, and net negative mass balance (supply to member system vs. demand of



member system). Minor issues were identified if velocities were above 4 ft/s but below 5 ft/s, pressures were between 35 psi and 40 psi, or demands exceeded supply by less than 1 MGD. Major issues were identified if velocities were above 5 ft/s, pressures were below 35 psi, or demands exceeded supply by 1 MGD or more.

No major issues were observed during any of the 2020 routine demand scenarios (AAD and MDD). All demand was satisfied without low system pressures, excessive pumping pressures, high head losses through transmission mains, or excessive velocities with one exception:

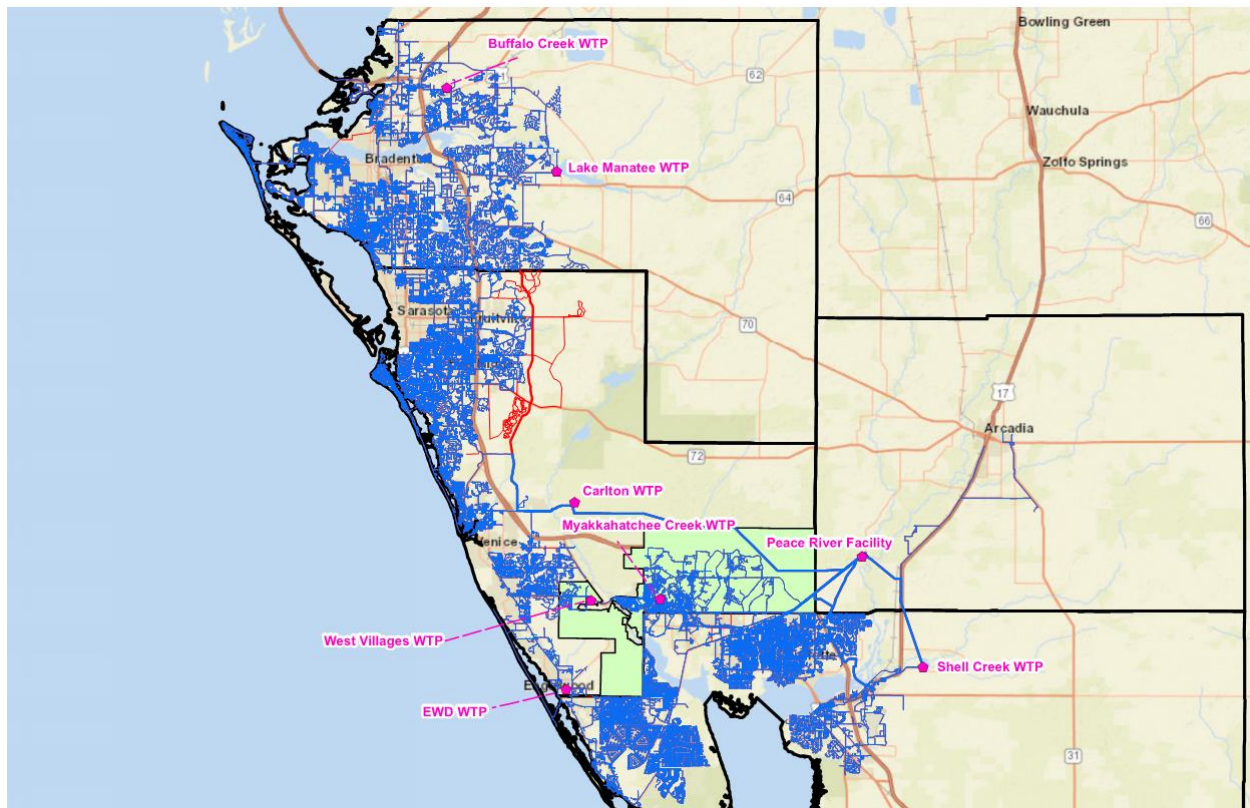
The modelling indicates that the Authority may have to temporarily increase the Peace River Facility discharge pressure to 80 or 85 psi to support delivery of 2020 MDD to Charlotte County at a delivery pressure above 65 psi.

For the 2040 modeling scenarios, model changes were implemented to reflect projected 2040 system conditions and demands. These model changes included the items listed below:

- The Authority's Phase III transmission system (Including Phase IIIB and IIIC) piping was assumed to be complete.
- In Sarasota County, the University Parkway WTP and Venice Gardens WTP are taken offline, and they were simulated as needed to be repurposed to a repump station (see Phase IIIC Extension discussion below). The Carlton WTP was assumed to be upgraded to a capacity of 15.0 MGD.
- Sarasota County is assumed to no longer import water from Manatee County.
- Manatee County is assumed to receive 5 MGD from the Authority through Phase III piping, and the Buffalo Creek WTP is assumed to be online at 3.0 MGD capacity.
- Charlotte County is assumed to receive all water from the Authority, and Punta Gorda is self-sufficient. (The Burnt Store WTP Service Area is isolated and not included in the model)
- North Port is assumed to have their Southwest WTP online at 2.0 MGD capacity

Figure 5.3 shows the modelled 2040 infrastructure. Red lines denote new piping from 2020 to 2040.

Figure 5.3 - Master Model 2040 Infrastructure

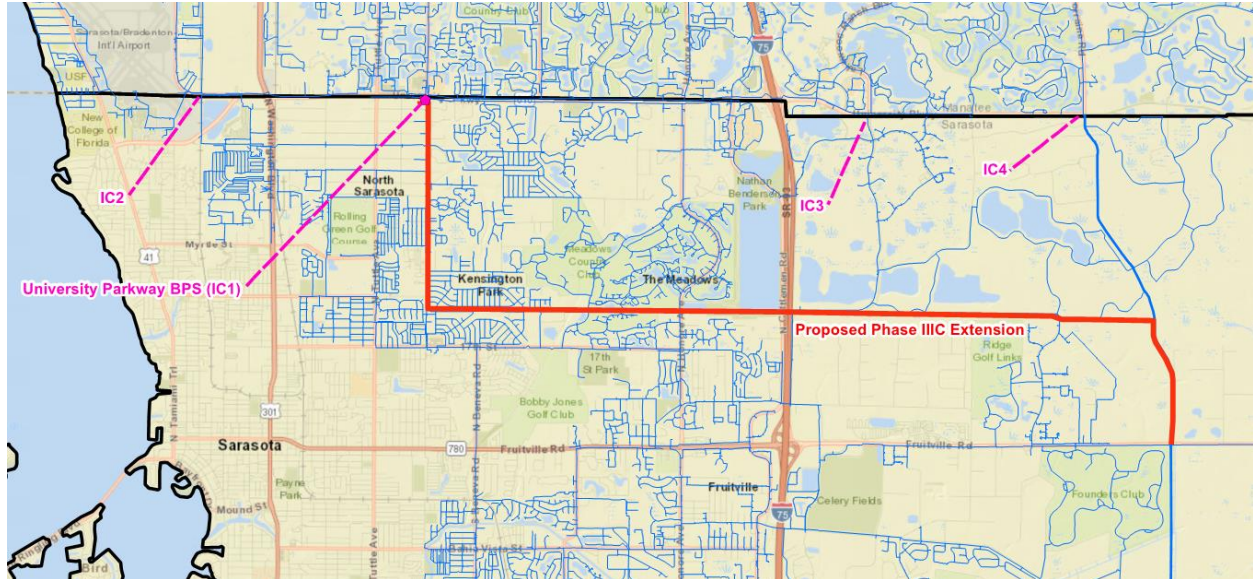


For the purposes of this evaluation it was assumed that member water production would be maximized and the Authority would provide the remainder of the supply required to satisfy demand within member systems. No major issues were observed during any of the 2040 scenarios. All demand was satisfied without low system pressures, excessive pumping pressures, high head losses through transmission mains, or excessive velocities throughout the entire distribution system. It should be noted that the flow achieved through the Phase 3 pipeline, and ultimately supplied to Manatee County at IC4, is highly dependent on elevated tank levels and pump operation in both Sarasota County and Manatee County. High tank levels in Sarasota and normal tank levels in Manatee allows approximately 5 MGD to flow to Manatee through IC4. Because of this potential operational complexity, an additional pipeline was modelled which was determined not to be needed in the 2015 Plan.

An additional scenario was created for 2040 which explored an alternative delivery location at IC1 (University Parkway WTP). This scenario as shown in Figure 5.4 would require approximately 10.8 miles of additional piping to connect the currently proposed end of the Phase 3B pipeline to the existing pump station at University Parkway WTP. This scenario would allow significantly more water to be sent to Manatee County while making delivery less dependent on tank levels on either side. If the additional piping is sized at 24", the high service pumps at University will allow approximately 8 MGD to be delivered to Manatee under normal operating conditions and keeps the

velocity in the Phase 3C Extension piping around 4 fps. A 30" main is modeled to convey up to 10 MGD under normal operating conditions at a velocity of 3 fps. These flows would be in addition to the flow through IC4, which is generally 1 MGD less than when IC4 is the only connection to Manatee County; thus, the total flow with a 30" Phase 3C Extension and operating IC4 would allow approximately 14 MGD to be delivered to Manatee County.

Figure 5.4 - Proposed Phase 3C Extension



It is recommended that the Authority continue to analyze the need for this alternative drop-off location as they proceed with the feasibility and routing study for the Phase IIIC Transmission Main.

2070 MDD conditions were simulated for the 2040 piping network to analyze the projected transmission system velocities. An excessive velocity would be an indicator of a future hydraulic restriction and a future need to add transmission system capacity to current or planned pipelines. Velocities above 5 ft/s were used as a threshold to analyze the need for additional pipeline capacity. There were no issues resulting from the 2070 MDD model scenario, therefore, there are no recommendations for additional transmission system capacity beyond what is currently installed, currently planned, and discussed in this section.

5.2.2 Out-of-Service (Emergency Supply) Scenarios

Though the Authority's current and proposed plan for pipeline capacities during normal operating conditions allows for adequate conveyance to meet required distribution system pressures and future demands, regional interdependencies can be highly stressed if treatment facilities or pipelines fail. This subsection highlights the results of the modeling efforts to simulate the system hydraulics with individual treatment facilities and major transmission mains offline.

Eight out-of-service scenarios were modeled in order to determine the feasibility of meeting demands with major infrastructure offline. These scenarios are as follows:

- Peace River Facility Offline
- Carlton WTP Offline and Phase IIIA Offline
- Lake Manatee WTP Offline
- 24" Phase 1A Offline
- 42" Phase 2 Offline
- 48" Phase 3A Offline
- 20" DRTM Offline
- 42" NRTM Offline

Through a desktop study, the Authority previously compiled a set of protocols for action should major water supply or transmission system infrastructure go out of service, including the above listed which were determined to be of highest concern and subject to validation with the Authority's new Master Model. The emergency operations actions were taken from the SOP for Regional Water Supply System Emergency Operation (HDR, December 2018) which can be found in Appendix C. The SOP outlines the steps that are to be followed per each separate scenario, and these steps were implemented in the model for each scenario and the results analyzed.

It is expected that less water will be consumed under emergency conditions as compared to normal conditions. Projected emergency demands for 2020 approximate current (2019) actual average usage. Demand in the 2040 emergency scenarios reflect projected 2040 AAD projected by the Authority's Customers and Partners. Table 5.3 summarizes these demands.

Table 5.3 - Emergency Scenario Demands

Member, Customer, or Partner	2020 Emergency Demands (MGD)	2040 Emergency Demands (MGD)
Charlotte County	10.20	17.53
DeSoto County	0.62	1.40
Manatee County	36.20	55.75
Sarasota County	19.94	29.70
City of North Port	3.30	10.76
City of Punta Gorda	4.50	5.05
Englewood Water District	3.00	3.19
SUM	77.76	123.38



5.2.3 Out-of-Service Modeling Results Summary

The details and assumptions of each emergency scenario are described in Appendix D. The transmission system and water supplies described under Section 5.2.1 above were utilized for the 2020 and 2040 emergency scenario infrastructure. The model runs were performed under steady-state conditions. Providing Member, Customer, and Partner demands with the regional available water supplies under the simulated emergency scenarios were categorized based on the following criteria:

- **Green** – Demand listed in Table 5.3 is met or exceeded by totalizing available supply methods
- **Yellow** – Demand exceeds the available supplies by less than 1.0 MGD
- **Red** – Demand exceeds the available supplies by 1.0 MGD or greater

The following observations were made per each model run:

5.2.3.1 Peace River Facility Offline

This scenario the results of a complete loss of the Peace River Facility (PRF). Table 5.4 summarizes the simulated supply to each Member, Customer, and Partner and the sources that provide the supply under the 2020 and 2040 scenarios.

Table 5.4 - PRF Out of Service Emergency Scenario Supplies

Member, Customer, or Partner	2020 Supply	2020 Supply Method	2040 Supply	2040 Supply Method
Charlotte County	10.20	5.0 (Punta Gorda) + 2.0 (Englewood) + 4.0 (North Port)	7.00 ⁽²⁾	5.0 (Punta Gorda) + 2.0 (Englewood)
DeSoto County	0.62	0.4 (DeSoto wells) + 0.4 (Arcadia)	0.80 ⁽¹⁾	0.4 (DeSoto wells) + 0.4 (Arcadia)
Manatee County	36.83	Self-Supplied	55.75	Self-Supplied
Sarasota County	19.94	14.0 (Manatee) + 6.35 (Carlton) + 2.0 (Venice Gardens) + 2.4 (University)	29.70	16.0 (Manatee) + 15.0 (Carlton)
City of North Port	3.30	Self-Supplied	9.30 ⁽²⁾	6.0 (Myakkahatchee) + 2.0 (West Villages) + 1.3 (Sarasota)
City of Punta Gorda	4.50	Self-Supplied	5.05	Self-Supplied
Englewood Water District	3.00	Self-Supplied	3.19	Self-Supplied

Notes:

⁽¹⁾ Demand exceeds available supplies by less than 1.0 MGD

⁽²⁾ Demand exceeds available supplies by 1.0 MGD or greater

No major issues were identified in the 2020 model scenario runs with the Peace River Facility off-line by using the Authority's SOP Protocols. Under this scenario, Manatee County, the City of North Port, the City of Punta Gorda, and Englewood are all self-supplied. Charlotte County is supplied by the excess capacity from Punta Gorda, Englewood, and North Port.

However, the 2040 model indicates that Charlotte County has a significant supply shortfall of 10.53 MGD (17.53 MGD demand vs. 7.0 MGD supply), and the City of North Port is projected to have a

supply shortfall of 1.46 MGD (10.76 MGD demand vs. 9.30 MGD supply). DeSoto County also have smaller shortfalls (<1 MGD) of supply. Charlotte County is projected to experience a supply shortfall without significantly more water being provided by the City of North Port, the City of Punta Gorda, the Englewood Water District and/or a new water supply from the Authority not located at the Peace River Facility. Installation of Phase IIB and Phase IIC Pipelines would allow for a more streamlined flow and additional transmission capacity from the Carlton WTP to North Port and Charlotte County; however, in this instance, the Carlton WTP would only be able to provide approximately 1.30 MGD of capacity to either municipality. Thus, approximately 10.69 MGD of additional treatment capacity must be identified to assist in supply shortfalls to Charlotte County and North Port. This could be through installation of the Peace River RO Facility and Brackish Wellfield project as discussed in Section 4.3.1.4 and isolating the new facility to operate independently of the current Peace River Facility. It could also be developed through the implementation of the Cow Pen Slough Surface Water Facility Development project identified in Section 4.3.3, or the expansion of the Carlton WTP beyond 15 MGD up to 19 MGD as discussed in Section 4.5.2. Charlotte County relies primarily on the Peace River Facility and thus its demands will have to be met by neighboring utilities that have significant excess capacity if the Peace River Facility were to be out of service.

5.2.3.2 Carlton WTP and Phase 3A Offline

This scenario models the results of a complete loss of service at the Carlton WTP and also the Phase 3A transmission main being out of service. This scenario assumes that no water from PRF can get beyond the Carlton WTP and thus no Authority water can be sent directly to Sarasota County. Table 5.5 summarizes the simulated supply to each Member, Customer, and Partner and the sources that provide the supply under the 2020 and 2040 scenarios.

Table 5.5 - Carlton WTP and Phase 3A Out of Service Emergency Scenario Supplies

Member, Customer, or Partner	2020 Supply	2020 Supply Method	2040 Supply	2040 Supply Method
Charlotte County	10.2	PRF	17.53	PRF
DeSoto County	0.62	PRF	0.94	PRF
Manatee County	36.83	Self-Supplied	55.75	Self-Supplied
Sarasota County	19.94	18.7 (Manatee) + 2.0 (Venice Gardens) + 2.4 (University) + 1.0 (City of Sarasota) + 1.0 (City of Venice)	23.00 ⁽²⁾	18.0 (Manatee) + 2.0 (North Port) + 1.0 (EWD) + 1.0 (City of Sarasota) + 1.0 (City of Venice)
City of North Port	3.30	Self-Supplied	10.76	6.0 (Myakkahatchee) + 2.0 (West Villages) + PRF
City of Punta Gorda	4.50	Self-Supplied	5.05	Self-Supplied
Englewood Water District	3.00	Self-Supplied	3.19	Self-Supplied

Notes:

⁽²⁾ Demand exceeds available supplies by 1.0 MGD or greater



No major issues are identified during the 2020 model scenario runs because Sarasota County's University Parkway WTP and Venice Gardens WTP, the City of Venice, the City of Sarasota, and Manatee County are able to make up the shortfall of supply created while the Carlton WTP is offline.

The 2040 model runs simulate that Sarasota County will have an 8.7 MGD supply shortfall. The proposed Phase 3C Extension as described earlier under normal conditions would route flow north and west from the Carlton WTP to the repurposed University Parkway repump station to provide flow to Manatee County; however, if the flow in this configuration is reversed to send flow south and east from Manatee County to the eastern side of Sarasota County, the supply from Manatee County to Sarasota County could increase by approximately 4 MGD for a total of 22 MGD. This is still less than the demand of Sarasota County, but it decreases the shortfall of 6.7 MGD by greater than half to 2.7 MGD. Additional considerations to overcome this shortfall include the following:

- Bypass the Carlton WTP with Authority water to utilize the Phase IIIA transmission main, and develop infrastructure to provide temporary re-disinfection as needed.
- Develop 5 MGD of additional regional water supply at the Peace River Facility that would deliver water to the Authority's Phase III transmission system.
- Provide a redundant line to the Carlton Water Treatment Plant by developing the future Phase IIB and IIC pipelines to connect the Peace River Facility to the Carlton WTP

5.2.3.3 Lake Manatee WTP Offline

This scenario models the results of a complete loss of the Lake Manatee WTP in Manatee County. Under this scenario, Manatee County would be reliant on existing interconnections to Sarasota County to supply all of the demand at 2020. Table 5.6 summarizes the simulated supply to each Member, Customer, and Partner and the sources that provide the supply under the 2020 and 2040 scenarios.

Table 5.6 - Lake Manatee WTP Out of Service Emergency Scenario Supplies

Member, Customer, or Partner	2020 Supply	2020 Supply Method	2040 Supply	2040 Supply Method
Charlotte County	10.20	PRF	17.53	PRF
DeSoto County	0.62	PRF	0.94	PRF
Manatee County	20.10 ⁽²⁾	20.1 (Sarasota)	21.00 ⁽²⁾	18.0 (Sarasota) + 3.0 (Buffalo Creek)
Sarasota County	19.94	Carlton + PRF + 2.0 (Venice Gardens) + 1.0 (University)	29.70	Carlton + PRF + 0.5 (City of Sarasota) + 2.0 (NP) + 1.0 (EWD)
City of North Port	3.30	Self-Supplied	10.76	Self-Supplied + PRF
City of Punta Gorda	4.50	Self-Supplied	5.05	Self-Supplied
Englewood Water District	3.00	Self-Supplied	3.19	Self-Supplied

Notes:

⁽²⁾ Demand exceeds available supplies by 1.0 MGD or greater

At 2020 emergency demands, Manatee County would potentially run out of water quickly under this emergency scenario. The high demands in Manatee County combined with the limited supply (36.2 MGD demand vs. 14 MGD available through the four existing Sarasota County Interconnects) would deplete the storage in the system and cause major issues if significant demand reductions were not implemented immediately following the shutdown of Lake Manatee WTP.

At 2040 AAD, the lack of supply is exacerbated. If the proposed Phase 3C Extension is installed, the supply from Sarasota County to Manatee County could increase by approximately 7 MGD for a total of 25 MGD, providing a total of 28 MGD to Manatee County in conjunction with the Buffalo Creek WTP. This is still significantly less than the demand of Manatee County. Additional considerations to overcome this deficit include the following:

- Develop 15 MGD of additional regional water supply that would deliver water to the Authority's Phase III transmission system near Manatee County.

5.2.3.4 24" Phase 1A Offline

This scenario models the results of a loss of the Phase 1A TM that generally runs north/south along I-75 through Charlotte County north of the Peace River and connects to the City of Punta Gorda. Under this scenario, water from PRF can only be delivered to Charlotte County via Harbor Blvd or Kings Blvd at Sandhill Blvd. Table 5.7 summarizes the simulated supply to each Member, Customer, and Partner and the sources that provide the supply under the 2020 and 2040 scenarios.

Table 5.7 - 24" Phase 1A TM Out of Service Emergency Scenario Supplies

Member, Customer, or Partner	2020 Supply	2020 Supply Method	2040 Supply	2040 Supply Method
Charlotte County	10.20	PRF via Harbor Blvd and Kings Hwy	17.53	PRF via Harbor Blvd and Kings Hwy
DeSoto County	0.62	PRF	0.94	PRF
Manatee County	36.20	Self-Supplied	55.75	Self-Supplied
Sarasota County	19.94	Carlton + PRF + 2.0 (Venice Gardens) + 1.0 (University)	29.70	Carlton + PRF
City of North Port	3.30	Self-Supplied	10.76	Self-Supplied + PRF
City of Punta Gorda	4.50	Self-Supplied	5.05	Self-Supplied
Englewood Water District	3.00	Self-Supplied	3.19	Self-Supplied

At both 2020 and 2040 emergency demands, no major issues arise under this emergency scenario.

5.2.3.5 42" Phase 2 Offline

This scenario models the results of a loss of the Phase 2 TM that generally runs northeast/southwest from PRF to the Charlotte County Harbor Blvd connection. Under this scenario, water from PRF will be limited to only the 36" SRTM along this route. Table 5.8 summarizes the simulated supply to each Member, Customer, and Partner and the sources that provide the supply under the 2020 and 2040 scenarios.



Table 5.8 - 42" Phase 2 TM Out of Service Emergency Scenario Supplies

Member, Customer, or Partner	2020 Supply	2020 Supply Method	2040 Supply	2040 Supply Method
Charlotte County	10.2	PRF via 36" SRTM and 24" Phase 1A	17.53	PRF via 36" SRTM and 24" Phase 1A
DeSoto County	0.62	PRF	0.94	PRF
Manatee County	36.20	Self-Supplied	55.75	Self-Supplied
Sarasota County	19.94	Carlton + PRF + 2.0 (Venice Gardens) + 1.0 (University)	29.70	Carlton + PRF
City of North Port	3.30	Self-Supplied	10.76	Self-Supplied + PRF
City of Punta Gorda	4.50	Self-Supplied	5.05	Self-Supplied
Englewood Water District	3.00	Self-Supplied	3.19	Self-Supplied

At both 2020 and 2040 emergency demands, no major issues arise under this emergency scenario.

5.2.3.6 48" Phase 3A Offline

This scenario models the results of a loss of the Phase 3A TM that generally runs east/west from Carlton WTP along Laurel Rd to Knights Trail Rd where it then runs north/south to the Sarasota County Preymore/681 connection. Under this scenario, water from Carlton WTP will be limited to only the Sarasota County 42" main that runs generally along Laurel Rd, but does not go north to the Preymore/681 connection. Table 5.9 summarizes the simulated supply to each Member, Customer, and Partner and the sources that provide the supply under the 2020 and 2040 scenarios.

Table 5.9 - 48" Phase 3A TM Out of Service Emergency Scenario Supplies

Member, Customer, or Partner	2020 Supply	2020 Supply Method	2040 Supply	2040 Supply Method
Charlotte County	10.20	PRF	17.53	PRF
DeSoto County	0.62	PRF	0.94	PRF
Manatee County	36.83	Self-Supplied	55.75	Self-Supplied
Sarasota County	19.90 ⁽¹⁾	10.5 (Carlton via SAR 42") + 5.0 (Manatee) + 2.0 (Venice Gardens) + 2.4 (University)	29.00 ⁽¹⁾	13.0 (Carlton via SAR 42") + 16.0 (Manatee)
City of North Port	3.30	Self-Supplied	10.76	Self-Supplied + PRF
City of Punta Gorda	4.50	Self-Supplied	5.05	Self-Supplied
Englewood Water District	3.00	Self-Supplied	3.19	Self-Supplied

Notes:

⁽¹⁾ Demand exceeds available supplies by less than 1.0 MGD

For both 2020 and 2040 emergency demands, no major issues arise under this emergency scenario. The results of this scenario are similar to the Carlton WTP out-of-service scenario, but this scenario has the advantage of partial use of the Carlton WTP, thus results are significantly less severe. Sarasota has a slight deficit in supply versus demand, but storage in the Sarasota system should be able to buffer this deficit for several days.

5.2.3.7 20" DRTM Offline

This scenario models the results of a loss of the 20" DRTM that generally runs northwest/southeast from PRF along 761 where it then runs north/south along US-17 to the DeSoto County connection. Under this scenario, DeSoto will be isolated from Peace River water and will be dependent upon their wells and their connection with Arcadia. Table 5.10 summarizes the simulated supply to each Member, Customer, and Partner and the sources that provide the supply under the 2020 and 2040 scenarios.

Table 5.10 - 42" DRTM Out of Service Emergency Scenario Supplies

Member, Customer, or Partner	2020 Supply	2020 Supply Method	2040 Supply	2040 Supply Method
Charlotte County	10.20	PRF	17.53	PRF
DeSoto County	0.62	0.4 (wells) + 0.4 (Arcadia)	0.80 ⁽¹⁾	0.4 (wells) + 0.4 (Arcadia)
Manatee County	36.20	Self-Supplied	55.75	Self-Supplied
Sarasota County	19.94	Carlton + PRF + 2.0 (Venice Gardens) + 1.0 (University)	29.70	Carlton + PRF
City of North Port	3.30	Self-Supplied	10.76	Self-Supplied + PRF
City of Punta Gorda	4.50	Self-Supplied	5.05	Self-Supplied
Englewood Water District	3.00	Self-Supplied	3.19	Self-Supplied

Notes:

⁽¹⁾ Demand exceeds available supplies by less than 1.0 MGD

At 2020 emergency demands, no major issues are identified. At 2040 emergency demands, DeSoto County has a slight deficit of 200,000 gpd. Assuming DeSoto has no additional well capacity, they may be reliant on Arcadia to make up the deficit in their supply. Depending on the location of the failure in the 20" DRTM and the ability to isolate it from the Phase 1 pipeline, DeSoto County may be able to receive the deficit from the Shell Creek WTP.

5.2.3.8 42" NRTM Offline

This scenario models the results of a loss of the 42" NRTM that generally runs east/west from PRF to Carlton WTP. Under this scenario, Carlton WTP will be isolated from Authority water. Table 5.11 summarizes the simulated supply to each Member, Customer, and Partner and the sources that provide the supply under the 2020 and 2040 scenarios.

Table 5.11 - 42" NRTM Out of Service Emergency Scenario Supplies

Member, Customer, or Partner	2020 Supply	2020 Supply Method	2040 Supply	2040 Supply Method
Charlotte County	10.20	PRF	17.53	PRF
DeSoto County	0.62	PRF	0.94	PRF
Manatee County	36.20	Self-Supplied	55.75	Self-Supplied
Sarasota County	19.94	6.35 (Carlton) + 14.0 (Manatee) + 2.0 (North Port) + 2.0 (Venice Gardens) + 2.4 (University)	29.70	15.0 (Carlton) + 16.0 (Manatee) + 2.0 (North Port)
City of North Port	3.30	Self-Supplied	10.76	Self-Supplied + PRF
City of Punta Gorda	4.50	Self-Supplied	5.05	Self-Supplied
Englewood Water District	3.00	Self-Supplied	3.19	Self-Supplied

At 2020 emergency demands, no major issues are modelled. At 2040 emergency demands, no major issues arise under this emergency scenario as long as the Carlton WTP is improved as planned to provide a finished water capacity up to 15 MGD by 2040. If this does not occur, then either the Phase IIB and IIC regional transmission mains would need to be constructed or the Authority would need to develop an additional 7.5 MGD of finished water capacity to be delivered to the Phase III regional transmission main for drop-off to Sarasota County.

5.3 Transmission Infrastructure Recommendations

Based on the hydraulic modeling simulations, the following observations are made for each proposed pipeline phase.

Extending the Phase II transmission main from the terminus at Serris Drive to the Carlton Water Treatment Plant could potentially provide additional transmission system benefits. The most critical observation is that it will provide a redundant pipeline to the Authority's 42" NRTM which is a vital supply line to supplement water at the Carlton WTP and meet the demands of Sarasota County, and eventually supply Manatee County. Since the Authority's current connection supplies water only to the eastern side of North Port, another benefit of extending the Phase II transmission main would be to provide better spatial distribution of Authority water as growth within the City is expected to occur in the western area. In turn, Carlton WTP could utilize the Phase IIC pipeline to deliver water more efficiently to Charlotte County or North Port if needed.

Phase III allows for the needed additional flows to Manatee County under normal conditions. Because all Sarasota County water is planned by 2040 to be fed from the southern part of the County, Phase III also allows for a much better spatial distribution of pressure and water age in the County under normal conditions. The hydraulic model during normal 2040 conditions with the proposed piping (including a 48" Phase IIIC) also does not require a booster pump station under

assumed customer elevated tank levels and limitations on delivery to Sarasota County on the future delivery points along Phase IIIB.

The proposed Phase IIIC Extension would allow for a better flow distribution to Manatee County under both normal and emergency conditions and allow for the continued use of the University Parkway High-Service Pump Station. As the Authority moves forward with planning for Phase III, extended period simulations could be run. Protocols could be also be discussed with Sarasota County and Manatee County during this phase to determine the need to continue with implementation of the Phase IIIB Booster Pump Station and determine additional delivery points, such as the Phase IIIC Extension.

Under emergency conditions, the vast majority of Charlotte County does not have its own water treatment infrastructure to provide a portion of water supply. Should the Peace River Facility be offline, Charlotte County will not receive enough water from Punta Gorda, Englewood, and North Port. With the installation of Phase IV, the Burnt Store WTP could help supply a portion of the 8.8 MGD deficit if the Burnt Store WTP were expanded with excess capacity. The remainder would need to be provided by additional regional water supplies such as the Carlton Regional Expansion Concept, Cow Pen Slough Surface Water Facility, Flatford Swamp Groundwater Recovery Concept, or Peace River RO Treatment Plant (if it is connected to independent power supply from the WTP). Likewise, if the Burnt Store service area is determined to require demand beyond the expansion capacity of the Burnt Store WTP, the Phase IV Pipeline could allow the Authority to provide the deficit.

Based on the observations, the following recommendations are made for each planned and proposed pipeline in the Authority's CIP and new piping considerations in Table 5.12.

Table 5.12 - Pipeline Recommendations

Pipeline	Length (Miles)	Nominal Diameter (Inches)	Recommendation
Phase IIB	10	36/42	Continue based on the spatial balance of growth in North Port and findings of the Charlotte County Master Plan, and future conveyance needs for EWD.
Phase IIC	14	36	Recommend proceeding with a Feasibility and Routing Study.
Phase IID	12.5	24	Reassess the need if WTP capacities surrounding Sarasota County do not proceed as planned
Phase IIIC	6.5	48	Recommend proceeding with a Feasibility and Routing Study
Phase IIIC Extension	10.8	30	Recommend proceeding with a Feasibility and Routing Study
Phase IV	15	24	Proceed as planned provided that either the Burnt Store WTP can be expanded by 2040 for additional capacity for distribution to the region or if Charlotte County requests the need for the Authority to supplement the Burnt Store service area demands.

For budgetary-level cost estimation purposes, easement widths, potential storage tank capacities, and potential booster pump station capacities along each future pipeline segment were developed in the 2015 Plan. These planning-level criteria are carried forward to the 2020 Plan and are shown in Table 5.13. As with the 2015 Plan, these requirements do not reflect the construction requirements, and the need for storage and booster pumping may be altered or eliminated during feasibility and preliminary design stages.

A preliminary environmental assessment is recommended during the initial planning stages of each proposed pipeline project. These assessments would give the Authority a general idea of the cost of environmental mitigation for impacts to protected habitats, including wetlands, and protected wildlife species, and allow them to show State and federal permitting agencies that alternative routes were evaluated. Another benefit of performing assessments during the initial stages of project planning is to reduce the likelihood of project delays due to unexpected environmental permitting issues.

Table 5.13 - Easements and Capacities of Pipeline Recommendations

Pipeline	Length (Miles)	Nominal Diameter (Inches)	Assumed Easement Width (ft)	Potential Storage Tank Capacity (MG)	Potential Pump Station Capacity (MGD)
Phase IIB	10	36/42	40	5	8
Phase IIC	14	36	35	3	6
Phase IID	12.5	24	35	2	4
Phase IIIC	10	48/24	50	10	10
Phase IIIC Extension (New)	10.8	30	35	0	0
Phase IV	15	24	35	2	4

5.3.1 Pipeline Cost Estimate Updates

As part of the 2020 Plan, preliminary cost estimates have been developed for all of the current pipeline recommendations as described in this Section. Since these are planning level cost estimates, the level of accuracy for these estimates will be greatly refined during detailed design and construction of each project. Due to limited details for each of the proposed projects, estimates are based on a general understanding of the features included as well as various contingencies to account for additional components that have not yet been determined.

This planning level estimate of probable construction cost is based on the recommended pipeline routes as shown in Figure 5.4. Costs for each segment have been broken down into capital construction costs and land cost estimates. Capital construction costs include the estimated total installed cost for transmission mains and appurtenances, storage tanks, booster pump stations, chemical feed facilities, instrumentation, and controls. Land costs for each proposed segment include estimated costs for pipeline easements (permanent and construction) and land acquisition costs for permanent facilities (i.e. buildings, storage tanks, etc.).

To determine planning level costs for each phase of the Regional Transmission System, the following methodologies have been considered:

- To evaluate unit costs for each phase, empirical cost methodologies (US DOI/BOR, 2017) have been used in conjunction with traditional cost methods for scale economies (Alpine & Tribe, 1986).
- All costs included in this report are based on the 2019 value of the U.S. Dollar (\$USD).
- Capital costs and unit costs for projects from previous years have been escalated using the Engineering News-Record (ENR, 2019) and RSMeans Historical Construction cost indices (RSMeans, 2019).
- An assumed non-construction capital cost (NCCC) of 15% of total construction cost has been included for engineering, permitting, construction management/oversight, and legal and administrative fees.
- A 5% mobilization cost was added to the total capital costs for construction for each phase to account for contractor mobilization costs.
- An assumed 30% contingency has been added to the total capital costs and NCCC for construction for each project to account for any undeveloped plans or considerations.
- All costs provided are planning level cost estimates (Class IV per AACEI).

5.3.1.1 Pipeline Costs

Pipeline unit costs were obtained from previous project estimates escalated to 2019 cost trends using the Engineering News-Record (ENR, 2019) and RSMeans Historical Construction cost indices (RSMeans, 2019). These cost estimates were then compared to the 2019 RSMeans Online

database for construction costs within the State of Florida, as well as traditional cost methodologies using scale economy principles (Alpine & Tribe, 1986). To establish a basis for pipeline construction as open cut or trenchless, an evaluation of the proposed layout for each pipeline was considered. Potential areas requiring trenchless installation (i.e. stream crossings, highways crossings, wetlands, etc.) were quantified to establish estimated linear footage of trenchless construction required, and the remaining linear footage of pipeline was assumed to be open cut construction. For trenchless pipeline installation, it was assumed that horizontal directional drilling (HDD) would be the preferred method of construction. Table 5.14 shows the estimated trenchless and open cut quantities for construction, as well as the expected total construction cost for each project phase.

Table 5.14 - Pipeline Costs

Pipeline	Trenchless (LF)	Open Cut (LF)	Cost (\$USD) ¹
Phase IIB	12,000	37,278	\$43,090,000
Phase IIC	20,000	56,635	\$50,896,000
Phase IID	6,000	60,305	\$24,973,000
Phase IIIC	500	32,700	\$23,977,000
Phase IIIC Extension (New)	6,500	50,524	\$24,649,000
Phase IV	3,000	78,311	\$28,569,000

¹Total construction cost includes 5% mobilization, 15% NCCC, and 30% contingency.

Based on the total capital construction costs determined for each phase, a correlation can be seen between the linear footage of trenchless installation and total construction cost. An example of this correlation can be seen between the total construction costs of Phase IIC and Phase IV. The total construction cost of Phase IIC and Phase IV are \$50.9M and \$28.6M, respectively, with a total installed linear footage of 76,635 LF and 81,311 LF, respectively. Although the total linear footage of Phase IIC exceeds the total linear footage of Phase IV, Phase IIC has an additional 17,000 LF of trenchless installation is required.

5.3.1.2 Facility Costs

Many phases include construction of new pump station/storage tank facilities in addition to pipeline installation. These facilities include various capacity pump stations, storage tanks, chemical feed systems, and all necessary metering, instrumentation and appurtenances.

Pump station costs were obtained using cost capacity curves derived in the *Basis for Cost Options* report (City of Alexandria, 2015). This report includes pump station costs for projects along the Eastern United States, and includes several local Florida pump station costs. Each pump station project cost was used to establish an empirical cost capacity curve. These costs were then

escalated to 2019 cost trends using the Engineering News-Record (ENR, 2019) and RSMeans Historical Construction cost indices (RSMeans, 2019).

Storage tank costs were based on planning level costs provided by CROM Corporation. CROM tanks have been used by Authority previously, and are expected to be used for future concrete storage tanks. Tanks were assumed to be above ground domed concrete potable water storage tanks. Tank costs were provided for 2, 5 and 10 million gallon capacities. Other tank capacity costs were extrapolated from these costs based on a linear function of cost vs capacity.

It was assumed that all pump stations would require chemical feed systems, metering, and various appurtenances. An additional 30% of the total construction cost was included to account for chemical feed systems, metering, and other miscellaneous items that are currently undeveloped. The total construction costs for facilities in each phase are shown in Table 5.15.

Table 5.15 - Facilities Costs

Pipeline	Potential Pump Station Capacity (MGD)	Potential Storage Tank Capacity (MG)	Pump Station Cost (\$USD)	Storage Tank Cost (\$USD)	Chemical Feed, Metering, and Appurtenances Cost (\$USD)	Total Cost (\$USD) ¹
Phase IIB	8	5	\$3,245,000	\$1,900,000	\$1,912,500.0	\$10,500,000
Phase IIC	6	3	\$2,519,000	\$1,380,000	\$1,298,700.0	\$7,960,000
Phase IID	4	2	\$1,793,000	\$1,110,000	\$933,900.0	\$5,920,000
Phase IIIC	10	10	\$3,960,000	\$3,220,000	\$3,018,000.0	\$14,650,000
Phase IIIC Extension (New)	0	0	\$0	\$0	\$0	\$0
Phase IV	4	2	\$1,793,000	\$1,110,000	\$933,900.0	\$5,920,000

¹Total construction cost includes 5% mobilization, 15% NCCC, and 30% contingency.

5.3.1.3 Land Costs

Land costs have been included for any easements that may be required along the proposed pipelines and at potential storage/pumping facility locations. Property costs were based on unit costs provided in the 2015 Plan and escalated to 2019 cost trends based on the Federal Housing Finance Agency Housing Price Index from 2015 to 2019 (Federal House Financing Agency, 2019). Unit costs used were assumed based on whether a portion of the pipe alignment would require a permanent pipeline easement (\$87,000/ac), a temporary pipeline construction easement (\$18,000/ac), or a permanent facility easement (\$172,500/ac). These considerations were evaluated using applicable easement requirements in conjunction with existing property ownership of parcels the proposed pipelines will intersect. Pipelines with a majority of the alignment located within road right-of-ways

have a significantly lower pipeline easement cost than alignments which travel through private land or protected areas. Table 5.16 shows the summary of total land costs for each phase.

Table 5.16 - Land Cost

Pipeline	Pipeline Easement Area (Acres)	Facility Site Size (Acres)	Pipeline Easement Cost (\$USD)	Facility Site Easement Cost (\$USD)
Phase IIB	41	6	\$742,000	\$1,035,000
Phase IIC	32	6	\$577,000	\$1,035,000
Phase IID	24	4	\$433,000	\$690,000
Phase IIIC	38	6	\$3,242,000	\$1,035,000
Phase IIIC Extension (New)	35	6	\$3,004,000	\$1,035,000
Phase IV	28	4	\$505,000	\$690,000

5.3.1.4 Planned Transmission System Cost Summary

Based on the unit costs determined for pipeline installation, pump station and storage tank facilities, and total land costs, an estimated total capital cost was determined for each project phase. Table 5.17 shows a summary of the unit cost and total capital cost for each phase.

Table 5.17 - Estimate of Probable Costs (Future Phases)

Pipeline	Pipeline Construction Cost (\$USD)	Storage, Pumping, Metering, Instrumentation & Chemical Feed Construction Cost	Pipeline Easement Cost (\$USD)	Facilities Easement Cost (\$USD)	Total Capital Cost (\$USD)
Phase IIB	\$43,090,000	\$10,500,000	\$742,000	\$1,035,000	\$55,367,000
Phase IIC	\$50,896,000	\$7,960,000	\$577,000	\$1,035,000	\$60,468,000
Phase IID	\$24,973,000	\$5,920,000	\$433,000	\$690,000	\$32,016,000
Phase IIIC	\$23,977,000	\$14,650,000	\$3,242,000	\$1,035,000	\$42,904,000
Phase IIIC Extension (New)	\$24,649,000	\$0	\$3,004,000	\$1,035,000	\$28,688,000
Phase IV	\$28,569,000	\$5,920,000	\$505,000	\$690,000	\$35,684,000
TOTAL	\$212,512,000	\$44,950,000	\$10,729,000	\$6,555,000	\$274,746,000

The total capital costs for all phases is expected to be \$274.7M, ranging between \$28.7M and \$60.5M for individual phase projects. As noted in the Pipeline section, the difference in cost for pipeline installation methodology, whether trenchless or open cut, has a significant impact on the total capital cost.

6 Water Conservation

Water conservation is a key component of an effective water supply planning process, and it is often one of the most cost effective, environmentally compatible and readily available alternatives to help manage the water supply needs of a growing population. The Authority Customers (Charlotte, DeSoto, Manatee and Sarasota Counties and the City of North Port) have long excelled at conservation efforts. Those efforts and opportunities for additional conservation progress are presented in this Section. For the purpose of this effort, water conservation includes supply and demand management as well as water use efficiency.

The effectiveness of water conservation efforts is illustrated in the gross and residential per capita water use for Authority member governments and customers from 2003 through 2017 in Section 6.1. An inventory of existing Water Conservation Programs for the Authority Customers is provided in Section 6.2.

Per capita water use rates are well below the SWFWMD per capita rate goal of no greater than 150 gallons per day. Part of this is due to passive water conservation associated with changes in the Florida Building Code which included more efficient indoor plumbing fixtures in new construction and replacement of older fixtures. In addition, the use of new, readily available and cost-competitive technologies such as EPA's WaterSense certified projects could continue to contribute to passive water conservation reductions in per capita rates. Other opportunities for increased and quantifiable water conservation include supply-side management measures such as reducing water losses and engagement of the Industrial-Commercial-Institutional (ICI) sector on water conservation initiatives.

6.1 Per-Capita Use

6.1.1 Gross Per-Capita Water Use

Gross per-capita water use for the Authority Customers were considered for a 15-year period based upon data reported by the utilities and compiled by SWFWMD in their annual Estimated Water Use Reports. Table 6.1 and Figure 6.1 present the populations served as reported by the Authority's Customers between 2003 and 2017.

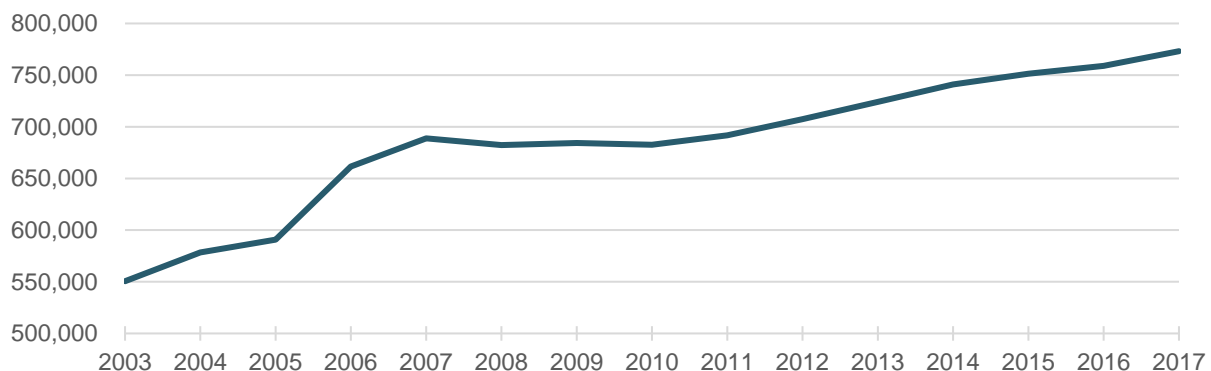
Table 6.1 - Population Served by Authority Customers

Year	DeSoto County (est.)	Charlotte County	Manatee County	Sarasota County	City of North Port	Total Population Served
2003	709	85,008	238,914	194,706	31,225	550,562
2004	877	86,557	253,263	201,920	35,721	578,338
2005	1,050	93,639	257,048	202,491	36,588	590,816
2006	3,416	126,028	290,656	201,095	40,342	661,537
2007	5,173	131,768	292,938	215,505	43,363	688,747
2008	6,575	124,795	295,280	216,508	39,095	682,253
2009	5,354	128,682	299,834	210,775	39,691	684,336
2010	6,317	126,392	301,097	206,853	41,867	682,526
2011	7,268	126,145	307,306	209,043	41,999	691,761
2012	6,666	129,950	313,109	213,039	44,579	707,343
2013	7,688	130,585	318,256	221,778	45,759	724,066
2014	8,709	131,480	325,356	228,977	46,483	741,005
2015	5,381	133,173	333,354	231,609	47,889	751,406
2016	5,186	135,755	341,928	226,601	49,450	758,920
2017	5,262	137,222	349,523	230,055	51,056	773,118

Note: All population values in Table 6.1 taken from SWFWMD annual Estimated Water Use Reports except:

- (1) Manatee County values for 2009 through 2012 based upon revised Public Supply Annual Reports provided by SWFWMD;
- (2) City of North Port value for 2011 based upon Public Supply Annual Report provided by SWFWMD; and
- (3) DeSoto County values for 2002 through 2013 which were estimated based upon the total annual water use provided the Authority and presented in Table 6.2 divided by the average annual regional per capita use provided in Table 6.3.

Figure 6.1 - Total Population Served by Authority Customers



As indicated in Table 6.1 and Figure 6.1, the aggregate population served by individual Authority Customers has increased 40% between 2003 and 2017 (a 2.7% annual increase). However, in the past decade (2007 to 2017), the increase in population served by the Authority Customers was only 12% (1.2% annually). Figure 6-1 also illustrates the economic boom between 2005 and 2007 and the resulting bust and recovery between 2007 and 2010. Table 6.2 and Figure 6.2 present the total water use in gallons per day as reported by the Authority's member governments and customers between 2003 and 2017.

Table 6.2 - Total Water Use by Authority Customers (gallons per day)

Year	DeSoto County (est.)	Charlotte County	Manatee County	Sarasota County	City of North Port	Total
2003	73,759	8,972,000	29,753,000	16,505,000	1,981,000	57,284,759
2004	92,085	9,645,000	30,703,000	17,585,000	2,703,000	60,728,085
2005	108,005	9,749,000	31,490,000	16,875,000	2,534,000	60,756,005
2006	334,556	11,023,000	32,819,000	17,917,000	2,693,000	64,786,556
2007	471,474	10,116,000	31,139,000	18,199,000	2,844,000	62,769,474
2008	583,789	9,656,000	29,597,009	17,748,167	2,996,000	60,580,965
2009	449,811	9,328,000	29,328,596	15,834,000	2,531,000	57,471,407
2010	539,370	9,464,000	30,041,425	15,856,000	2,373,000	58,273,795
2011	607,189	9,419,000	28,810,647	16,474,000	2,479,607	57,790,443
2012	550,825	9,860,000	28,429,140	16,994,000	2,611,000	58,444,965
2013	596,913	10,280,000	29,307,000	16,571,000	3,107,000	59,861,913
2014	643,000	10,455,000	29,502,000	17,387,000	2,902,000	60,889,000
2015	505,000	10,407,000	29,795,000	18,387,000	2,900,000	61,994,000
2016	651,000	10,548,000	31,462,000	18,454,000	2,957,000	64,072,000
2017	781,000	11,017,000	31,906,000	18,662,000	3,283,000	65,649,000

Note: All water use values in Table 3.2 taken from SWFWMD annual Estimated Water Use Reports except:

- (1) Manatee County values for 2008 through 2012 based upon revised Public Supply Annual Reports provided by SWFWMD;
- (2) City of North Port value for 2011 based upon the Public Supply Annual Report provided by SWFWMD;
- (3) Sarasota County value for 2008 based upon Public Supply Annual Report provided by SWFWMD; and (4) DeSoto County values which were provided by the Authority.



Figure 6.2 - Total Water Use by Authority Customers



As indicated in Table 6.2 and Figure 6.2, overall the Authority Customer aggregate water use has increased approximately 15% over the past 15 years (a 1% annual increase). A dramatic change associated with the boom and recession between 2003 and 2009 essentially re-set water usage back six years. However, in the past decade the average annual increase in total water use for the Authority Customers was 0.5%.

Table 6.3 and Figure 6.3 present the average gross per-capita water use in gallons per person per day for the Authority Customers for each of the past 15 years. There was no reported data for Desoto County from 2003 through 2012, so the regional annual average gross per-capita was assumed for those years.

Table 6.3 - Gross Per Capita Water Use by Authority Customers (gpcpd)

Year	DeSoto County	Charlotte County	Manatee County	Sarasota County	City of North Port	Average Per Capita
2003	104.0	105.5	124.5	84.8	63.4	104.0
2004	105.0	111.4	121.2	87.1	75.7	105.0
2005	102.9	104.1	122.5	83.3	69.3	102.8
2006	97.9	87.5	112.9	89.1	66.8	97.9
2007	91.1	76.8	106.3	84.4	65.6	91.1
2008	88.8	77.4	100.2	82.0	76.6	88.8
2009	84.0	72.5	97.8	75.1	63.8	84.0
2010	85.4	74.9	99.8	76.7	56.7	85.4
2011	83.5	74.7	93.8	78.8	59.0	83.5
2012	82.6	75.9	90.8	79.8	58.6	82.6
2013	82.7	78.7	92.1	74.7	67.9	82.7
2014	73.8	79.5	90.7	75.9	62.4	82.2
2015	93.8	78.1	89.4	79.4	60.6	82.5
2016	125.5	77.7	92.0	81.4	59.8	84.4
2017	148.4	80.3	91.3	81.1	64.3	84.9

Figure 6.3 - Average Gross Per-Capita Water Use for Authority Customers

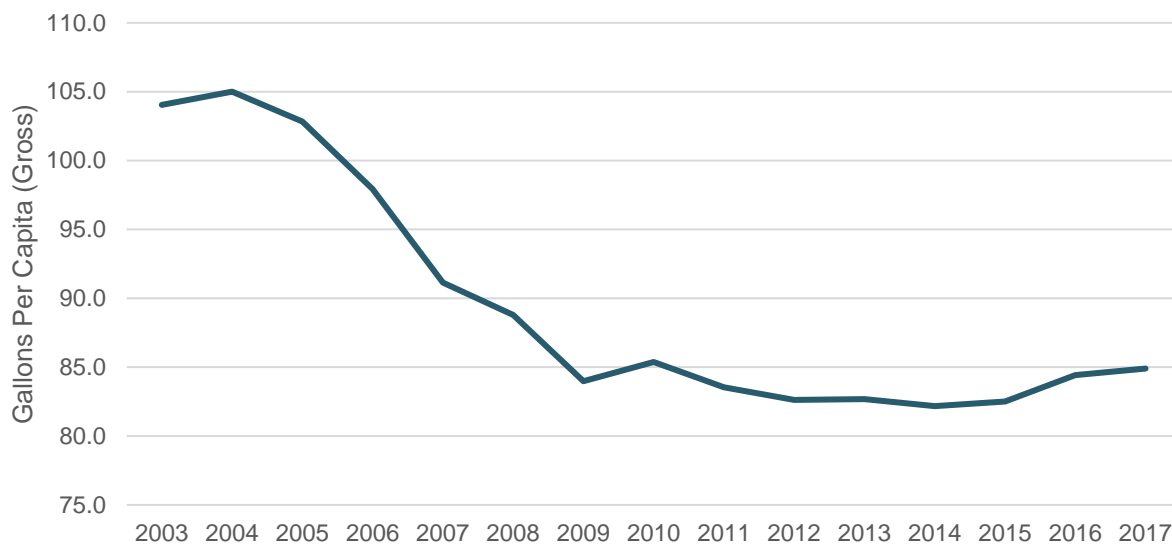




Table 6.3 and Figure 6.3 show that overall the gross per-capita water use for Authority Customers has decreased 18%, from 104 gpcpd to 84.9 gpcpd over the past 15 years (an annualized reduction of 1.2%). However, in the past decade, the average annual decrease in per capita water use by the Authority Customers has slowed to 0.7%. The dramatic decrease in gross per capita use corresponds in part to the economic downturn but that alone does not fully explain the reduction in per capita water use for the region. As indicated by Figure 6.1 and Figure 6.2, while the population served by Authority Customers has increased by approximately 40% between 2003 and 2017, the total water use has increased by only 15%. This is due in part to an 18% decrease in the gross per-capita water use as indicated by Figure 6.3. In the past decade, the population served by the Authority Customers has increased by approximately 12% while the total water use has only increased approximately 4.6%. The gross per-capita water use has decreased approximately 6.8% over the past 10 years. It is also noted that the long-term trend in decreasing gross per capita water use has slowed and in recent years has even begun to increase slightly.

6.1.1 Residential Per-Capita Water Use

The gross per-capita rates presented in Section 6.1.1 are based upon the total water use which includes the system water losses and the following three water use sectors:

- Single-family residential
- Multi-family residential
- Industrial-Commercial-Industrial (ICI)

Since the gross per-capita water use is based upon the total water use divided by the population served, a more uniform method of comparing per-capita water use is to deduct the water system losses and the ICI water use from the total water use prior to dividing by the population served. This is referred to as the residential per-capita water use.

Since 2008, SWFWMD's annual Estimated Water Use reports have provided residential per-capita water use. Table 6.4 summarizes the SWFWMD residential per-capita water use for the member governments and customers as available for 2008 through 2017 from SWFWMD's annual Estimated Water Use Reports with the following exceptions: (1) 2008-2012 SWFWMD residential per-capita values for Manatee County which are based upon revised Public Supply Annual Reports provided by SWFWMD; (2) 2011 SWFWMD residential pre-capita value for City of North Port which is based upon Public Supply Annual Report provided by SWFWMD; and (3) 2008 SWFWMD residential per capita value for Sarasota County which is based upon Public Supply Annual Report provided by SWFWMD.

Table 6.4 - SWFWMD Residential Per-Capita Water Use for Authority Customers

Member/ Customer	SWFWMD Residential Per-Capita (gpcpd)									
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Desoto County	NA	NA	48	NA	NA	53	69	93	28	27
Charlotte County	59	55	54	54	56	53	50	54	54	55
Manatee County	71	66	67	67	61	63	63	64	64	66
City of North Port	51	43	40	40	38	37	35	37	38	38
Sarasota County	62	57	54	59	60	56	56	57	59	59
Average Per Capita	65	60	59	60	58	57	57	59	59	60

As indicated in Table 6.4, SWFWMD's residential per-capita water use for Authority Customers in the region has generally averaged between 55 and 60 gallons per person per day since 2008.

For comparison, Table 6.5 presents the SWFWMD residential per capita water use for other water providers in southwest Florida.

Table 6.5 - SWFWMD Residential Per-Capita Water Use in Southwest Florida (gpcpd)

Member/Customer	SWFWMD Residential Per Capita (gpcpd)
City of Bradenton	59
City of Palmetto	47
City of Sarasota	46
City of Venice	42
Englewood Water District	56
City of Punta Gorda	95
City of Arcadia	69
City of Tampa	68
Hillsborough County	81
City of St. Petersburg	48
Pinellas County	54
City of Clearwater	48

6.2 Inventory Existing Water Conservation Programs

This section inventories the existing water conservation Water Conservation Programs (WCP) of the Authority's Customers. To assist in the development of potential future WCP initiatives, WCP are distinguished by whether they relate to supply-side or demand-side management. In addition, it is noted if the WCP applies to indoor or outdoor water conservation.

Water conservation can be either quantitative or qualitative. Water conserved by quantifiable means is reasonably predictable and can be measured with some reliability. Alternatively, water saved by qualitative means such as education, while of value to a comprehensive water conservation program, is difficult and often not possible to measure or reliably predict.

The Supply Side Management water conservation strategies include:

- Tiered water rate programs (quantitative; applicable to both indoor and outdoor use, but more effective in reducing outdoor water use)
- Tiered reclaimed water rate programs (quantitative; primarily applicable to outdoor use)
- Water audit and leak detection programs (quantitative; applicable to both indoor and outdoor use)
- Water line looping to reduce flushing (quantitative; applicable to both indoor and outdoor use)
- Increased Ground Water Recovery – Treatment/Withdrawal Efficiency (quantitative; applicable to both indoor and outdoor use)

The Demand Side Management water conservation strategies include:

- Toilet replacement and rebate programs (quantitative; applicable to indoor use)
- Faucet replacement and rebate programs (quantitative; applicable to indoor use)
- Showerhead replacement and rebate programs (quantitative; applicable to indoor use)
- Washing Machines replacement and rebate programs (quantitative; applicable to indoor use)
- Soil Moisture Sensors (quantitative; applicable to outdoor use)
- ET Controllers (quantitative; applicable to outdoor use)
- Landscape and irrigation retrofit programs (qualitative; applicable to outdoor use)
- Landscape and irrigation regulations (qualitative; applicable to outdoor use)
- Incentives for new construction (quantitative; applicable to outdoor use)
- Public outreach/education programs (qualitative; applicable to indoor and outdoor use)

Water Conservation Plans for each Authority Customer's Water Use Permit were reviewed, as available, to determine current programs. Table 6.6 provides an inventory of current WCPs for each of the Authority's Customers.



Table 6.6 - Water Conservation Program Inventory for Authority Customers

Water Conservation Program	DeSoto County	Charlotte County	Manatee County	Sarasota County	City of North Port
<i>Supply Management</i>					
Tiered Potable Water Rate Program	yes	yes	yes	yes	yes
Tiered Reclaimed Water Rate Program	no	yes	no	no	no
Water Loss (2017)	38.8%	4.6%	5.5%	9.8%	28.2%
Water Audit and Leak Detection Program	no	no	no	no	no
<i>Indoor Demand Management</i>					
Single Family Residential Water Fixture Retrofit	no	yes	yes	yes	no
Multi-Family Residential Water Fixture Retrofit	no	yes	yes	yes	no
ICI Water Fixture Retrofit	no	no	no	no	no
<i>Outdoor Demand Management</i>					
Landscape/Irrigation Retrofit	no	no	yes	no	no
Landscape/Irrigation Ordinance	no	yes	yes	yes	yes
Landscape/Irrigation Incentives	no	no	yes	no	no
<i>General</i>					
Standard Entitlement Conditions	no	no	yes	yes	no
Public Outreach and Education	yes	yes	yes	yes	yes

Table 6.6 indicates that all Authority Customers have tiered rates for potable water, and Charlotte County has tiered rates for reclaimed water. In addition, Charlotte, Manatee and Sarasota Counties have offered programs for indoor demand management (i.e. rebates to incentivize toilet, showerhead, and faucet retrofits). Relative to outdoor water use, Charlotte, Manatee and Sarasota Counties as well as the City of North port all have landscape/irrigation ordinances that primarily apply to new construction. Manatee County has a comprehensive rebate program to incentivize existing customers to reduce the use of potable water for irrigation. The City of North Port's landscape/irrigation ordinance allows for reductions in the ERC calculation for LEED Certified, Silver, Gold, or Platinum, Florida Water Star certification or properties containing a gray water system. All Authority Customers also have water conservation education programs.

Active water conservation encompasses a variety of measures, practices, and programs sponsored or encouraged by utilities and municipal governments which result in water use reductions. By their nature, active water conservation programs are typically funded and administered by utilities or other regional entities. Other active quantifiable water conservation strategies that could be considered by the Authority Customers might include:



- Require Residential Single-Family WaterSense Toilet Retrofit on Resale
- Require Residential Multi-Family WaterSense Toilet Retrofit on Resale
- Offer High-Efficiency Clothes Washer Retrofit Rebates
- Require Residential Multi-Family Sub-metering
- Offer ICI Sector Water Audits
- Offer ICI Sector WaterSense Toilet/Urinal Retrofit Rebates
- Offer ICI Sector High-efficiency Washer Rebates

Water savings can also be passive. Passive water conservation savings refer to water savings that occur as a result of users implementing water conservation measures in the absence of utility incentive programs. These are typically the result of building codes, manufacturing standards, and ordinances that require the installation of high-efficiency plumbing fixtures and appliances in new construction and renovations. Passive water conservation has been observed as a major contributor to decreasing per capita water use across the country. There are two components of passive water conservation savings as follows:

- **Natural Replacement Savings:** This accounts for water savings that occur as a result of the natural fixture and appliance replacements during the planning horizon. This occurs as older devices reach the end of their service lives or are otherwise replaced by newer, more efficient models.
- **Water Savings Adjustment Factor:** Newer homes built over the planning horizon are more efficient in their indoor water use than existing older homes.

Conservation and demand management can reduce, defer, or eliminate the need to develop new water supply sources. This approach has been adopted at the national level and within the state of Florida. Conservation is often preferable to expensive AWS type projects because it is a more cost-effective means of generating a sustainable water supply for future populations and water uses.

7 Capital Improvement Planning Recommendations

7.1 Background

The Authority's mission includes the responsibility to plan, develop, and provide high quality drinking water to its Members and Customers, to help meet their growing demands. Each of these Members and Customers have their own water treatment facilities, which currently meet either a fraction or all of the demands. This section presents Capital Improvement Plan recommendations to best address these future needs. The Plan was developed from information presented in previous sections and may serve as a capital program guide for the years 2020 through 2040.

7.2 Regional Water Supply Capacity Summary

Section 2 of this 2020 Plan summarizes the current water regional water sources, water treatment plan efficiencies, and permitted finished water capacities through the year 2040. For objective capital improvement planning of the Authority's water supply and transmission system, the projected Member and Customer water demands must be compared to their corresponding regional water supply capacities. Regional water supplies that are considered include permitted AAD and PMD water supplies with installed water treatment plants. These regional water supplies are summarized in Table 7.1.



Table 7.1 - Available Regional Water Supply Capacity

Customer or Member	Water Treatment Plant	Water Use Permit AAD (MGD)	Water Use Permit PMD (MGD)	Hydraulic Capacity Limit (MGD)	Treatment Efficiency (%)	Finished Water Capacity AAD (MGD)	Finished Water Capacity PMD (MGD)
Manatee County	Lake Manatee WTP	52.85	68.38	70.00	100	52.85	68.38
Sarasota County	University Parkway WTP ¹	2.00	2.40	2.40	100	2.00	2.40
	Carlton WTP	7.30	9.63	9.63	66	4.82	6.35
	Venice Gardens WTP ²	4.43	4.47	4.47	60	2.66	2.68
Charlotte County	Burnt Store WTP	3.17	4.12	3.61	79	2.51	2.85
DeSoto County	DCI WTP	0.82	1.10	0.88	85	0.70	0.75
City of North Port	Myakkahatchee Creek WTP	4.40	6.00	5.28	Varies ³	3.30	3.96
Authority	Peace River Facility	80.00		51.00	100	34.70	41.65
Sum						103.53	129.04

Notes:

(1) University Parkway WTP to be offline in 2025.

(2) Venice Gardens WTP finished water capacity to decrease to 1.5 MGD AAD, 1.8 MGD PMD in 2025, then be offline in 2030

(3) The surface water treatment portion of the Myakkahatchee Creek WTP has no treatment losses. The RO treatment portion of the Myakkahatchee Creek WTP has a treatment efficiency of 75%.

In 2020, the available regional finished water capacity is 103.53 MGD AAD and 129.04 MGD PMD.

In 2025, the University Parkway WTP is planned for decommissioning, and the Venice Gardens WTP is expected to be derated to a finished water capacity of 1.5 MGD AAD and 1.8 MGD PMD. These reductions yield a 2025 regional finished water capacity of 100.37 AAD and 125.75 PMD.

By 2030, the Venice Gardens WTP are expected to be decommissioned, which yields a 2025 finished water capacity of 98.87 MGD AAD and 123.95 MGD PMD.

It is Sarasota County's intention to relocate the WUP quantities of the University Parkway WTP and Venice Gardens WTP over to the Carlton Memorial Reserve Wellfield when both facilities are decommissioned. This relocation would allow for a future Carlton WTP expansion; however, this requires permitting and new infrastructure. Thus, these permit relocations are considered in a Planned Carlton Wellfield Upgrades project for future growth in Section 4 and not carried forward in the baseline of regional finished water supply capacities.

7.3 Demand Projections Summary

Section 3 of this 2020 Plan identifies a range of future annual average demand projections derived from growth methodologies using Authority Customer projections, actual regional water use, BEBR population estimates, and SWFWMD projections. From seven demand projection methods, a most probable annual demand projection for the region is the median demand projection for the range of demands. These demands, which were established in Table 3.18 are used to as the basis for CIP planning.

Consistent with Section 3.1.6, the Authority has adopted the “17% Capacity Standard” BMP which include maintenance of a “6% Rotational Reserve Capacity” and compliance with a “90% Capacity Standard”. The 6% Rotational Reserve Capacity is added to the most probable regional projected demands to identify “total projected demands.” The 90% Capacity Standard calls for new water supply capacity to be completed and online prior to total projected demands (i.e. projected demands + 6% Rotational Reserve) exceeding 90% of the prevailing available annual average finished water supply capacity. The 90% Capacity Standard BMP provides a reasonable safety factor to ensure there is always sufficient average day production capacity available considering that it typically takes five or more years to develop a new water supply source. The 6% Rotational Reserve and 90% Capacity Standard combined application to projected demands results in a required “total finished water capacity” that is approximately 17% (16.597%) above projected demands.

Section 3 projection methodologies also evaluated peaking factors to confirm Master Water Supply Contract’s use of 1.2 and 1.4 as the ratio of PMD use to AAD use and MD use to AAD use, respectively. These peaking factors were verified by referencing all PRF finished water flow data collected from 2008 through 2018. . Finished water distributed to Customers must satisfy the full range of annual demands; therefore, the maximum day peaking factor is also used in CIP planning.

Table 7.2 presents the Authority Customers’ and Members’ most probable annual average projected demand through 2070, the addition of the Authority’s 17% capacity standard, total AAD finished capacity required, and projected PMD finished capacity required. The available regional finished water capacity is also identified. Figure 7.1 presents the same information for the years 2020 through 2040.

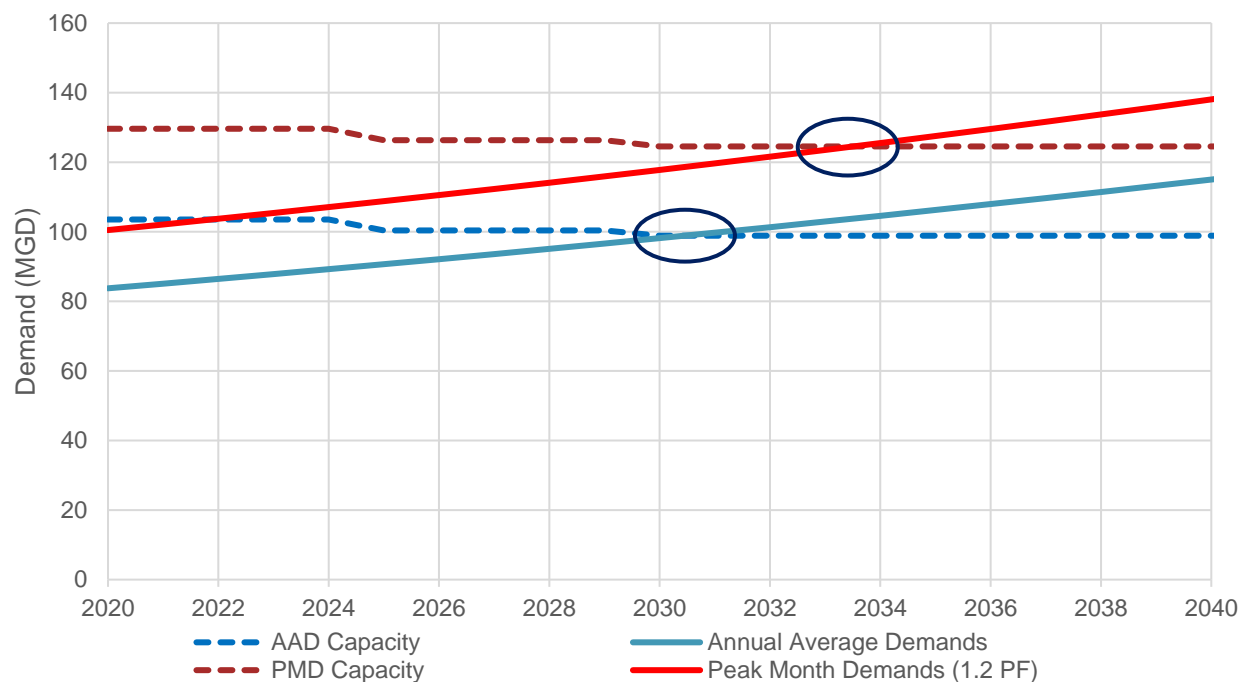


Table 7.2 - Regional Finished Capacity Required for Most Probable Demands

Year	Most Probable Projected Demand (MGD)	17% Capacity Standard (MGD)	Total AAD (MGD)		Total PMD (MGD)	
			<i>Finished Capacity Required</i>	<i>Finished Capacity Available</i>	<i>Finished Capacity Required</i>	<i>Finished Capacity Available</i>
2020	71.83	11.92	83.75	103.53	100.50	129.62
2021	72.98	12.11	85.09	103.53	102.11	129.62
2022	74.15	12.31	86.45	103.53	103.74	129.62
2023	75.33	12.50	87.84	103.53	105.41	129.62
2024	76.54	12.70	89.24	103.53	107.09	129.62
2025	77.76	12.91	90.67	99.87	108.80	129.62
2026	79.01	13.11	92.12	99.87	110.54	125.54
2027	80.27	13.32	93.59	99.87	112.31	125.54
2028	81.56	13.54	95.09	99.87	114.11	125.54
2029	82.86	13.75	96.61	99.87	115.93	125.54
2030	84.19	13.97	98.16	98.87	117.79	124.54
2031	85.53	14.20	99.73	98.87	119.68	124.54
2032	86.90	14.42	101.33	98.87	121.60	124.54
2033	88.29	14.65	102.95	98.87	123.54	124.54
2034	89.71	14.89	104.59	98.87	125.51	124.54
2035	91.14	15.13	106.27	98.87	127.52	124.54
2036	92.60	15.37	107.97	98.87	129.56	124.54
2037	94.08	15.61	109.69	98.87	131.63	124.54
2038	95.59	15.86	111.45	98.87	133.74	124.54
2039	97.12	16.12	113.23	98.87	98.87	124.54
2040	98.67	16.38	115.04	98.87	98.87	124.54
2070	158.85	26.37	185.22	98.87	98.87	124.54

Table 7.2 demonstrates that by 2040, the required finished water capacity will exceed the available regional finished water capacity by 16.17 MGD AAD and 13.91 MGD PMD. Furthermore, the required finished water capacity will exceed the available regional finished water capacity by 86.35 MGD AAD and 97.72 MGD PMD by 2070.

Figure 7.1 - Regional Finished Capacity Required for Most Probable Demands



The data presented in Table 7.2 and Figure 7.1 highlight that the regional AAD finished water capacity is projected to exceed the regional most probable demand by 2031. The regional PMD finished water capacity is not projected to exceed the regional most probable demand until 2034. Therefore, the AAD is assumed to be the limiting factor for demand needs and should serve as the basis for CIP project planning.

7.4 Regional Water Needs and Prioritization

Section 4 of this report identifies 137.5 MGD yield of potential water supply development projects. This yield is 51.15 MGD greater than the projected 2070 AAD and 39.78 MGD greater than the projected 2070 PMD. A robust set of water development projects have been identified; however, the permitting feasibility for each project may change over time due to surface water and groundwater uses. Therefore, it is recommended the Authority continue to investigate these potential water source development projects with their Members and Customers to refine implementation priority when needed.

The following table (Table 7.3) summarizes the water source development projects described in Section 4 of this report. The information includes projected finished water yield, Class IV planning-level costs per AACEI, project benefits, and potential challenges.



Table 7.3 - Regional Water Sources Summary

Project	Yield (MGD)	Capital Cost (\$M)	Capital Cost (\$/kgal yield) *	O&M Cost (\$/kgal yield)	Total Cost (\$M/kgal yield)	Benefits	Challenges
West Villages Brackish Wellfield	2	26.0	2.32	2.49	4.81	Permitted. Provides new water supply in area of growth.	Design/construction timeline to be determined. Susceptible to market conditions. Potential water quality variation due to saltwater intrusion.
Peace River Facility Raw Water ASR	0	8.3	N/A	N/A	N/A	Will significantly decrease the cost of ASR. Will provide better recovered water quality for treatment. Will free up water treatment capacity. Over-recharging the system could occur to offset local groundwater withdrawal impacts. Regional project cooperative funding likely available. Reservoir Pump Station will alleviate flow restrictions to the WTP when the WTP capacity is expanded.	FDEP Permit is pending. Operation will need to consider water quality parameters prior to the property boundary.
Peace River Facility Phase II Capacity Increase and ASR Wellfield Expansion	4.5	32.3	1.28	0.81	2.09	Capacity increase needs minimal footprint. Cost effective addition. Regional project cooperative funding likely available.	ASR Wellfield Expansion not cost feasible without PTW ASR being permitted, which is pending per Raw Water ASR project above. Yield with corresponding reliability requires additional storage.
Peace River Facility Surface Water System Expansion	15	332.2	3.95	0.99	4.94	Water use permit in-hand. Provides for increased reliability with infrastructure collocated to existing. Continues low cost surface water treatment. Regional project cooperative funding likely available.	Wetland mitigation
Peace River Facility Brackish Wellfield	5.5	58.3	1.89	2.07	3.96	Provides alternative water supply for Authority. Regional project cooperative funding likely available.	Groundwater withdrawal capacity may be limited by MIA boundary impacts.
Manatee County Buffalo Creek Brackish Wellfield	3	38.3	2.28	2.45	4.72	Provides alternative water supply for Manatee County.	Not permitted yet.
Cow Pen Slough Surface Water Facility Phase 1	5	82.8	2.95	2.05	5.00	Provides for Dona Bay historic ecosystem restoration and creates drinking water in turn. Water supply diversion already exists for conveyance to a storage reservoir. Cooperative funding likely available if this is an Authority project.	Requires membrane treatment. Not fully permitted yet; however the diversion exists.



Project	Yield (MGD)	Capital Cost (\$M)	Capital Cost (\$/kgal yield) *	O&M Cost (\$/kgal yield)	Total Cost (\$M/kgal yield)	Benefits	Challenges
Cow Pen Slough Surface Water Facility Expansion	10	N/A	N/A	N/A	N/A	Further restores Dona Bay and creates more drinking water. Cooperative funding likely available if this is an Authority project.	Requires Albritton property mining to finish which is beyond 2040. Not permitted yet
DeSoto Brackish Wellfield Near DCI	5	78.5	2.80	2.24	5.04	Regional project cooperative funding likely available.	Not permitted yet.
Shell and Prairie Creeks Surface Water Facility	20	442.4	3.94	3.40	7.35	Regional project cooperative funding likely available.	Lower Shell Creek MFL to be adopted in 2020 and anticipated to be in recovery. Obtaining a permit for water supply is unlikely.
Blackburn Canal Surface Water System	5	179.7	6.40	3.30	9.70	Provides for Curry Creek and Roberts Bay historic ecosystem restoration and creates drinking water in turn. Regional project cooperative funding likely available.	Not permitted yet.
Seawater Desalination Facility Near Port Manatee	20	271.8	2.42	3.16	5.58	Provides a large quantity alternative water supply to the region. Regional project cooperative funding likely available.	Permitting of seawater withdrawals must mitigate potential habitat damage including aquatic life, sediments, sea grasses, and hard-bottom communities. Impacts to seagrasses would require wetland mitigation. Surface saltwater intake prior to membrane treatment is problematic and requires robust screening, pre-treatment, and maintenance. Not permitted yet.
Seawater Desalination Facility Near Venice Airport	20	287.4	2.56	3.17	5.73	Provides a large quantity of alternative water supply to the region. Regional project cooperative funding likely available.	Permitting of seawater withdrawals must mitigate potential habitat damage including aquatic life, sediments, sea grasses, and hard-bottom communities. Impacts to seagrasses would require wetland mitigation. Surface saltwater intake prior to membrane treatment is problematic and requires robust screening, pre-treatment, and maintenance. Not permitted yet.
Flatford Swamp Groundwater Recovery Concept	5	113.4	4.04	1.00	5.04	Flatford Swamp Recharge offsets impacts to SWUCA and MIA. Provides an alternative water source to the region. Provides regional water to the northern side of the region. Negates the need for a storage reservoir for seasonal water supply availability. Anticipated to require low-cost treatment. Regional project cooperative funding likely available.	Permitting hinges on Flatford Swamp Recharge operation. Could require the Authority to operate the Flatford Swamp Recharge System. Not permitted yet.



Project	Yield (MGD)	Capital Cost (\$M)	Capital Cost (\$/kgal yield) *	O&M Cost (\$/kgal yield)	Total Cost (\$M/kgal yield)	Benefits	Challenges
Planned Carlton Wellfield Upgrades	7.5	28.7	0.68	0.45	1.13	Allows for groundwater withdrawal to be relocated away from the MIA. Provides expansion to the middle of the region. Provides water treatment expansion on property close to transmission system.	Requires water use permit relocation. Not permitted yet.
Carlton Regional Expansion Concept	4	53.4	2.38	2.36	4.74	Allows for groundwater withdrawal outside of the MIA without causing regional impacts. Provides expansion to the middle of the region. Provides water treatment expansion on property close to transmission system.	Requires water use permit for additional withdrawal quantities. May require agreement with Sarasota County for property acquisition, site access, and/or daily operations. Not permitted yet.
High Salinity Groundwater Desalination	10	173.2	3.09	3.32	6.41	Concept that utilizes water below the USDW as a resource. Could potentially slow or reverse saltwater intrusion. Regional project cooperative funding likely available.	Collocating concentrate injection with existing/future reclaimed water injection could require long pipelines and agreement with local municipality. Permitting would need to show no impact to SWUCA. Not permitted yet.
Partially Treated Water Aquifer Recharge	0	3.5	N/A	N/A	N/A	Will provide better water quality for ASR recovery if coupled with ASR. Over-recharging the system could occur to offset regional SWUCA groundwater impacts. Could allow for groundwater credits within region based on recharge influence. Regional project cooperative funding likely available.	Operation will need to consider coliform inactivation and meeting other WQ parameter requirements prior to the property boundary. Not permitted yet.
Indirect Potable Reuse	TBD	TBD	TBD	TBD	TBD	Provides alternative water supply to the region. Provides for beneficial use of excess reclaimed water that is currently disposed. Regional project cooperative funding likely available.	Requires partnership and long term agreement with local municipality for access to reclaimed water. Treatment system cost could vary greatly depending on siting of the indirect potable reuse infrastructure, unit processes selected, and potential changes in funding assistance/grants. Not permitted yet.

Note
* Capital Cost (\$/kgal yield) calculated by dividing an annual cost by the anticipated finished water yield. Annual cost determined by applying a 30-year term loan on capital cost with an interest rate of 5%.

The flowing discussion prioritizes the key elements of the least expensive and most feasible water supply projects for prioritization to meet the Authority's water supply planning needs to 2040.

As shown in Table 7.3, Sarasota County's Planned Carlton Wellfield Upgrades project has the lowest estimated normalized project cost (\$1.13/kgal yield) of all identified projects, and it is projected to provide a finished water yield of 7.5 MGD. Sarasota County is already under construction for the Carlton WTP Upgrades with an anticipated cost of \$50M to treat this additional water supply; however, the permit for this project has not been obtained. It is anticipated that the quantities could be self-relocated from the University Parkway Wellfield and the Venice Gardens Wellfield when their corresponding treatment facilities are taken offline. Completing this project would increase water supply in the middle of the region, and it would add benefits for Customers during emergency scenarios. The Authority should continue discussing the timing of this project with Sarasota County.

The Authority's Phase II Capacity Increase and ASR Wellfield Expansion has the second lowest estimated normalized project cost (\$2.09/kgal yield) of all identified projects, and it is projected to provide a finished water yield of 4.5 MGD. The required water treatment plant modifications can be readily implemented to increase finished water quantity to the region. As discussed in Section 5, additional regional capacity is needed for the region. However, the Authority's reliability will decrease unless additional storage capacity (i.e. ASR Wellfield expansion or new regional reservoir) is included. The ASR Wellfield expansion project would require permit approval of PTW ASR. Therefore, it is recommended that the Authority either continue efforts with FDEP to determine the feasibility of PTW ASR or achieve their storage needs through additional reservoir capacity.

The Peace River Facility Brackish Wellfield project has the third lowest estimated normalized project cost (\$3.96/kgal yield) of all identified projects and could provide a finished water yield of 5.5 MGD. However, this project adds only a small portion of the supply capacity required to meet the Authority's finished water needs by 2040. The water supply permit for this project has not been granted. In addition, SWFWMD may require mitigation for impact from these withdrawals at the MIA boundary.

Manatee County's Buffalo Creek Brackish Wellfield project has the fourth lowest estimated normalized project cost (\$4.72/kgal yield) of all identified projects. The water use permit for this facility has been obtained, and Manatee County expects this project to be online by 2033. This facility would be constructed in northern Manatee County in the area of the greatest projected increase in demand. This project would provide capacity to Manatee County, and it would provide some redundancy to the County in an emergency scenario; however, there are no plans to connect the future Buffalo Creek RO WTP more efficiently to the regional transmission system.



The Carlton Regional Expansion project has the fifth lowest estimated normalized project cost (\$4.74/kgal yield) of all identified projects. Preliminary modeling indicates that this project could be feasible; however, the permit would need to be obtained, and SWFWMD may require mitigation for impact from these withdrawals at the MIA boundary. This project estimates a finished water yield of 4 MGD. Development of this project would benefit the region for emergency scenarios.

The West Villages Brackish Wellfield has the sixth lowest normalized project cost (\$4.81/kgal yield) of all identified projects. The water supply for this project is permitted, and the West Villages Improvement District anticipates this project to be online by 2022 with a finished water yield of 2.025 MGD. This project will help supply North Port's growing western service area.

The Peace River Surface Water System Expansion has the seventh^{26.0} lowest estimated normalized project cost (\$4.94/kgal yield) of all identified projects. The project's estimated 15 MGD yield increase, when combined with the Phase II Capacity Increase and ASR Wellfield Expansion, the Peace River Facility Brackish Wellfield project, or the Carlton Regional Expansion Project will meet Authority Regional Customer demands through 2040. The water use permit for the Surface Water System Expansion has been granted and will secure this water supply until 2069. This project has applied for FY 2021 SWFWMD Cooperative Funding and been ranked high for a feasibility study. Continued receipt of SWFWMD Cooperative Funding through design and construction would provide significant subsidization to project costs. This project could also incorporate the storage capacity needed to achieve the reliability sought in the Phase II Capacity increase and ASR Wellfield Expansion project.

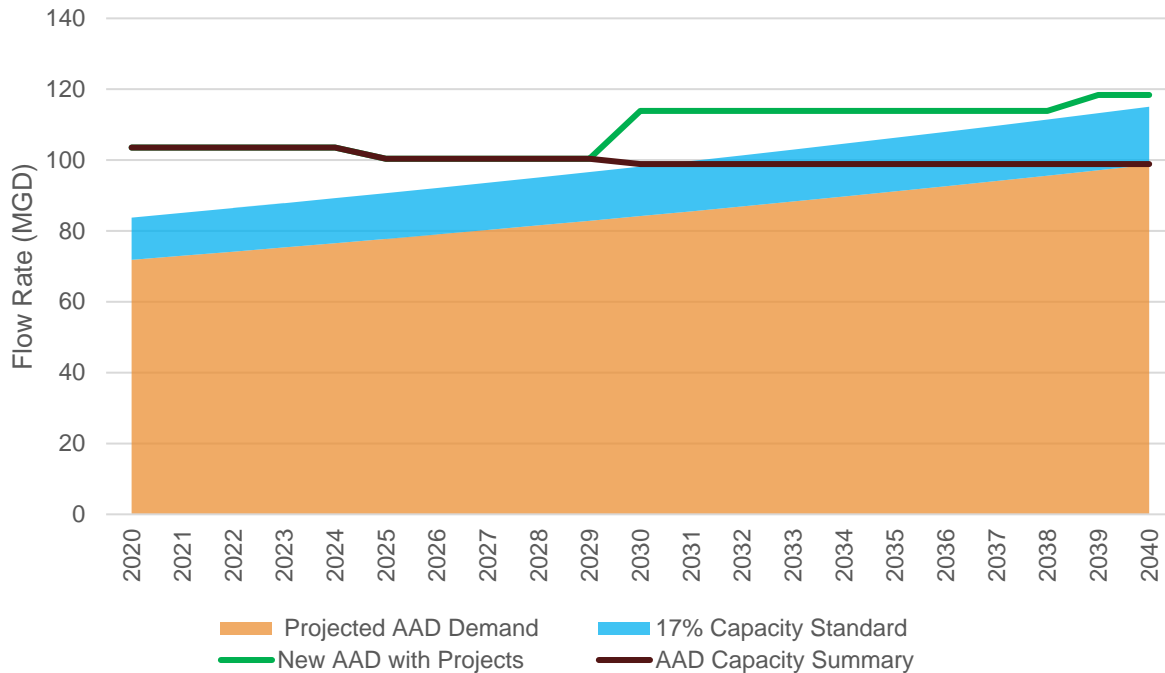
Though the Peace River Facility Raw Water ASR project permitting is pending, the Reservoir Pump Station portion of this project is valuable to the Authority. This Reservoir Pump Station is recommended to be constructed by 2030 in line with the Peace River Surface Water System Expansion project completion so as to alleviate the hydraulic restriction that would occur between Reservoir No. 1 and the WTP at a maximum capacity above 54 MGD.

It is recommended that the Authority continue to weigh the feasibility of implementing the Phase II Capacity Increase and ASR Wellfield Expansion, the Peace River Facility Brackish Wellfield project, or the Carlton Regional Expansion Project to have at least one project online by 2039. All three projects have permitting issues, and all three projects have merit. The combination of implementing all three of these projects, in addition to development of Sarasota County's Planned Carlton Wellfield Upgrades and Manatee County's Buffalo Creek Wellfield would create a more resilient region to emergency scenarios.

Figure 7.2 demonstrates the projected supply benefits achieved through the Peace River Surface Water System Expansion and the Phase II Capacity Increase and ASR Wellfield Expansion projects.

The additional finished water yield is projected from a recommended 2030 implementation through 2040. This information is presented with current water supply capacity and can be compared against the most probable AAD through 2040 and the 17% Capacity Standard.

Figure 7.2 - Regional Finished Capacity Required for Most Probable Demands



Based on the most probable demand projections, additional regional finished water capacity will be needed by 2030, with up to 7.4 mgd AAD by 2035 and 16 mgd AAD by 2040. It is recommended that the Authority continue to assess the feasibility of implementing the Peace River Facility Expansion project to meet the needs over the next 20-year planning horizon. The Authority will likely need to implement additional supply projects shortly after 2040. New projects may take up to 10 years to develop; therefore, it is recommended that the Authority continue to assess the feasibility of implementing either the Phase II Capacity Increase and ASR Wellfield Expansion, Peace River Facility Brackish Wellfield, the Carlton Regional Expansion, and begin project implementation by 2030.

Though there is no estimated yield associated with the Partially Treated Water Aquifer Recharge project or the Peace River Facility Raw Water ASR project, continuing to pursue these projects would provide a significant benefit to the operational cost of the Authority's ASR System. The construction costs of these two projects are an order of magnitude less expensive than the lower yield projects outlined in Table 7.3. The Aquifer Recharge project could supplement regional Upper Florida Aquifer water levels and provide the Net Benefit demonstration, if required, for the Peace



River Facility Brackish Wellfield project. It is recommended that the Authority carry these projects forward in their CIP and continue to pursue the approval of the pending FDEP operation permit for PTW ASR. Should that permit be approved, it is recommended that these two projects are immediately considered for implementation.

7.5 Regional Transmission Prioritization

The Authority's Strategic Plan relies on the regional transmission infrastructure to meet the conveyance requirements associated with the projected Member and Customer demands discussed in Section 5. A regional interconnected system facilitates responsible water sharing between communities. Each municipality within the Authority's four-county region has a different level of dependence on the regional supply. Though some municipalities are self-sufficient under normal conditions, the regional interconnected system will be critical during emergency situations. Regional transmission of drinking water allows for the four-county region to grow naturally and efficiently supplement the pressures needed in concentrated growth areas. Furthermore, a regional interconnected system allows for optimization of excess treatment capacities within the region's individual distribution systems.

Regional transmission needs will evolve over time as communities are developed, population grows in concentrated or wide-spread areas within municipality jurisdictions, and local water source developments are expanded or restricted. As the Authority continues to plan, it is recommended that the IRWSP 2020 Master Transmission System Model be applied and updated to help address the growing water infrastructure needs.

Table 7.4 summarizes the recommended regional transmission piping projects through 2040, associated projected costs, overall benefits, and projected timelines needed to be online.

Table 7.4 - Regional Transmission Main Summary

Pipeline	Length (Miles)	Nominal Diameter (Inches)	Pipeline and Easement Cost	Storage and Booster Station Facilities Cost	Total Cost	Benefits	Recommendation	Current CIP/CNA Start Date	Current CIP/CNA Completion Date	Recommended Completion Date
Phase IIB	10	36/42	\$43,832,000	\$14,045,000	\$57,877,000	<ul style="list-style-type: none"> Will support spatial balance of growth in North Port and western Charlotte County Aligns with Charlotte County Master Plan Along with Phase IIC will create a redundant supply to the Carlton WTP 	Proceed with a Feasibility and Routing Study based on h recommendations of Charlotte County Master Plan, spatial growth of North Port, and future conveyance needs for EWD	2022	2026	2026
Phase IIC	14	36	\$51,473,000	\$9,865,000	\$61,338,000	<ul style="list-style-type: none"> Along with Phase IIB will create a redundant supply to the Carlton WTP Will provide an avenue for Charlotte County to be supplied by the Carlton WTP if the Peace River Facility goes offline 	Proceed with a Feasibility and Routing Study in tandem with Phase IIB Routing	2032	2036	2036
Phase IID	12.5	24	\$25,406,000	\$7,040,000	\$32,446,000	<ul style="list-style-type: none"> Connects EWD to the Regional System which could provide for better excess water sharing 	Long Term Evaluation - Reassess the need if WTP capacities surrounding Sarasota County do not proceed as planned	2035	2039	2040
Phase IIIC	10	48/24	\$35,347,867	\$22,255,000	\$57,602,867	<ul style="list-style-type: none"> Supports Manatee County's requested 5 MGD demand by 2037 Supplies approx. 5 MGD to Manatee County during emergency conditions Helps boost Sarasota County's northern distribution system pressures after University Parkway WTP comes offline before 2030. 	Proceed with Feasibility and Routing Study Install prior to University Parkway WTP coming offline in 2025	2021	2029	2028
Phase IIIC Extension	10.8	30	\$27,653,000	\$1,035,000	\$28,688,000	<ul style="list-style-type: none"> Supports Manatee County's requested 5 MGD demand by 2037 Supplies an additional approx. 9 MGD to Manatee County during emergency conditions (14 MGD with Phase IIIC) Repurposes the University Parkway Pump Station to a Booster Station. Helps boost Sarasota County's northern distribution system pressures after University Parkway WTP comes offline before 2030. 	Proceed with a Feasibility and Routing Study in tandem with Phase IIIC. Install by 2025 to provide Manatee County emergency supply.	--	--	2028
Phase IV	15	24	\$29,074,000	\$7,040,000	\$36,114,000	<ul style="list-style-type: none"> Connects Burnt Store WTP service area to the Regional System which could provide for better excess water sharing Could facilitate larger regional water sharing if the Burnt Store WTP can be expanded for additional capacity for regional distribution Could supplement the Burnt Store service area demands if needed in the future 	Re-evaluate following completion of Charlotte County Master Plan	2034	2039	2040

7.6 Water Source and Transmission Main Recommendations

The previous sections summarized an evaluation of potential projects that may support Authority's ability to meet finished water demands through 2040. The outcome of this evaluation informed the following recommended actions for the Authority to include within their overall 5-year CNA and 20-year CIP.

Existing infrastructure maintenance and rehabilitation projects are not included in this discussion

Within the Authority's 5-year CNA:

- Proceed with the Peace River Facility Surface Water System Expansion project and the reservoir pump station portion of the Raw Water ASR project to have them online by 2030.
- Should the Authority's PTW ASR permit application be accepted, plan for proceeding with the ASR Wellfield Expansion portion of the Phase II Capacity Increase and ASR Wellfield Expansion project, the Raw Water ASR project, and the Partially Treated Water Aquifer Recharge project.
- Proceed with Feasibility and Routing Study of Phase IIIC and Phase IIIC Extension to have them online by 2028.
- Proceed with Feasibility and Routing Study of Phase IIB and IIC by 2021 to have at least Phase IIB online by 2026.

Additionally within the Authority's 20-year CIP:

- Proceed with the Phase II Capacity Increase and ASR Wellfield Expansion, Peace River Facility Brackish Wellfield project, and/or Carlton Regional Expansion Project continue observing regional demand growth to plan bringing the facility online after 2040.
- Plan for construction Phase IIC to be complete by 2036.
- Plan to reevaluate Phase IV beginning in 2034.
- Plan to reevaluate Phase IID beginning in 2035.

Table 7.5 illustrates a preliminary schedule for the above-mentioned projects for the Authority to consider.

Table 7.5 – Capital Improvement Schedule Considerations

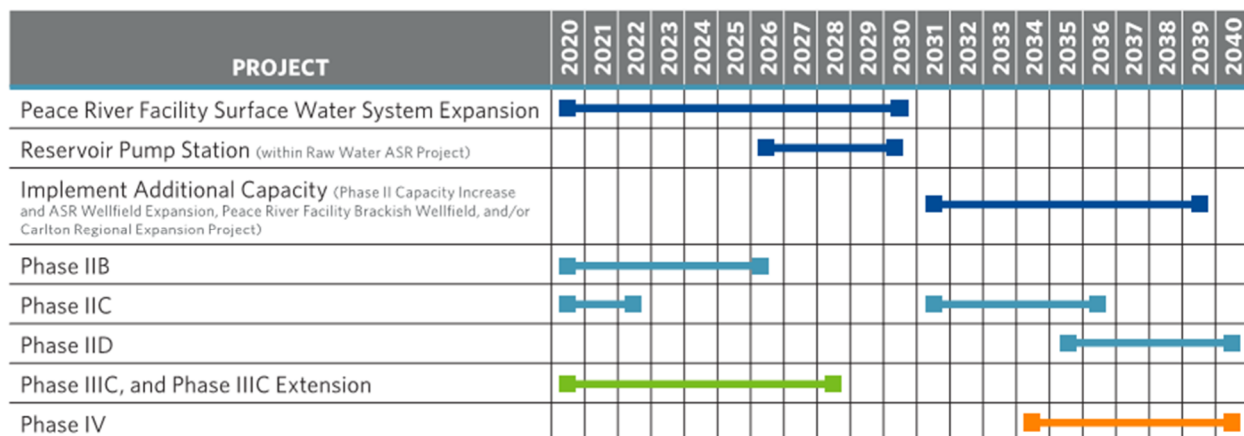


Figure 7.3 provides an aerial view of all potential water supply projects and transmission system projects considered to carry forward in this IRWSP 2020.

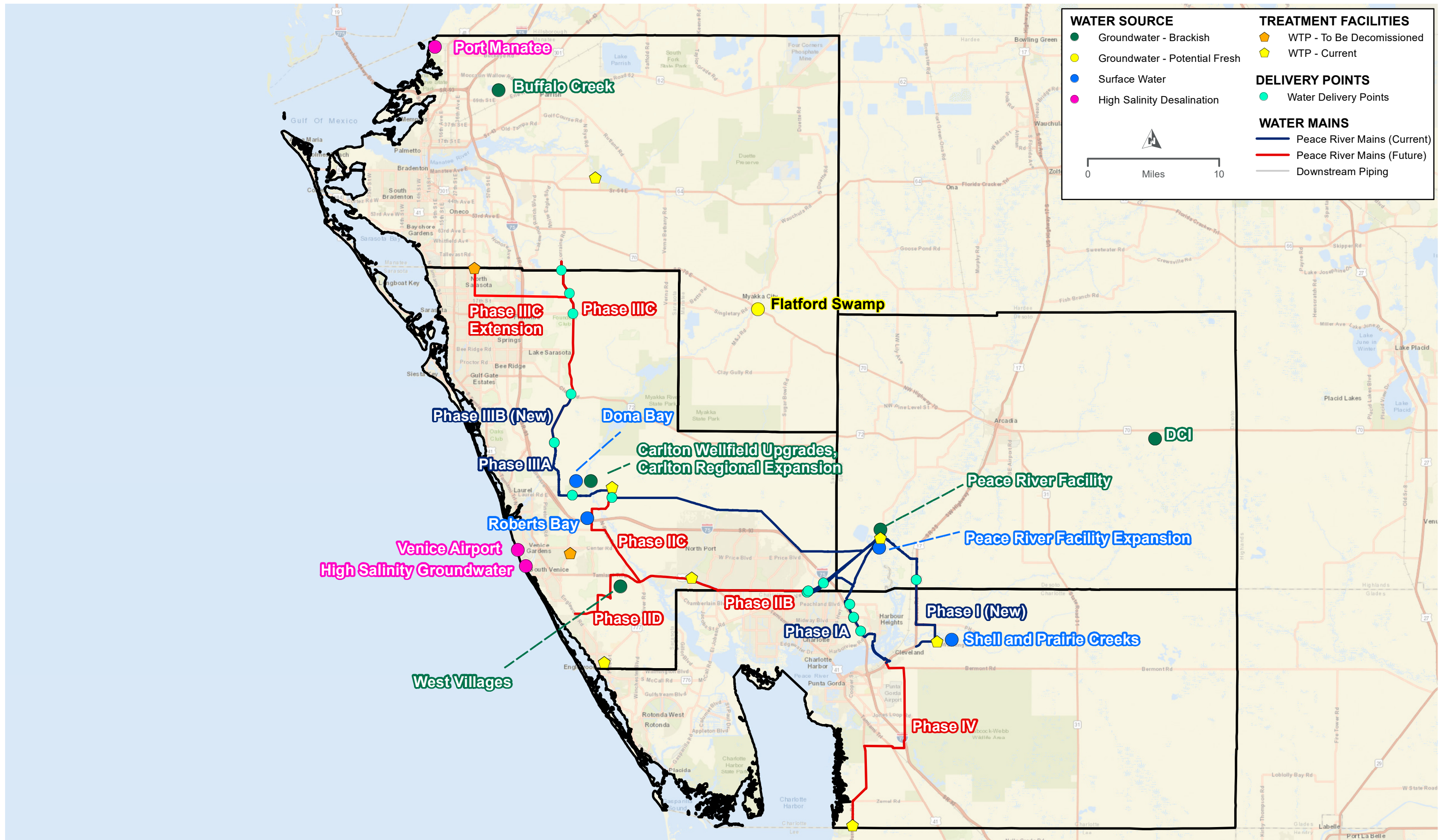


FIGURE 7.3 - SUMMARY OF EXISTING AND POTENTIAL REGIONAL INFRASTRUCTURE
INTEGRATED REGIONAL WATER SUPPLY PLAN 2020

7.7 Opportunities to Share Excess Water Capacity

The region may have an opportunity to further leverage the regional interconnected transmission and distribution system of the Authority, Customers, Members, and Partners to expand on sharing excess finished water capacities. Efficient use of the regional transmission system may further regional resiliency and potentially reduce/delay the need for the capital projects described above. The region currently has an OFWUP, described in Section 2.1.1, which allows the Authority temporary operational flexibility, if the PRF goes partially or fully offline. This OFWUP can provide short-term emergency benefit, but not serve as a reliable average day supply to meet growing needs; however, there is potential to extend water sharing opportunities across the region for holistic regional growth management. This subsection looks at this long- term potential.

Table 7.5 (next page) summarizes the Authority's Members', Customers', and Partners' current permitted finished water capacities, their projected demands, and the excess capacity at each. The Customer provided demand projections were the highest demand projections of all projection methods analyzed; therefore, the excess capacity calculated is conservative (See Table 3.16, Section 3).



Table 7.6 - Projected Supply vs. Demand Excess Capacity Sharing Opportunity

		Projected Annual Average (MGD)				
		2020	2025	2030	2035	2040
Charlotte County	Finished Water Capacity (Table 2.1)	18.61	18.61	18.61	18.61	18.61
	Demand Projections (Table 3.1)	15.73	17.18	18.65	19.96	21.22
	Excess Capacity	2.88	1.43	-0.04	-1.35	-2.61
DeSoto County	Finished Water Capacity (Table 2.2) ¹	0.68	1.37	1.37	1.37	1.37
	Demand Projections (Table 3.2)	0.68	1.37	1.39	1.40	1.40
	Excess Capacity	-0.03	0.03	-0.03	-0.03	-0.03
Manatee County	Finished Water Capacity (Table 2.3)	47.85	52.85	52.85	55.85	60.85
	Demand Projections (Table 3.5)	40.98	44.12	47.36	51.34	55.75
	Excess Capacity	6.87	8.73	5.49	4.51	5.10
Sarasota County	Finished Water Capacity (Table 2.4)	29.54	24.04	24.04	24.04	24.04
	Demand Projections (Table 3.3)	22.98	24.90	26.50	28.10	29.70
	Excess Capacity	6.56	-0.86	-2.46	-4.06	-5.66
North Port	Finished Water Capacity (Table 2.5)	6.17	8.19	8.19	8.19	8.19
	Demand Projections (Table 3.4)	3.68	5.64	7.2	8.93	10.76
	Excess Capacity	2.49	2.55	0.99	-0.74	-2.57
Punta Gorda	Finished Water Capacity (Table 2.6)	8.09	8.09	8.09	8.09	8.09
	SWFWMD Demand Projections (Appendix A -Table 19)	4.47	4.65	4.83	4.94	5.05
	Excess Capacity	3.62	3.44	3.26	3.15	3.03
Englewood	Finished Water Capacity (Table 2.7)	4.16	4.16	4.16	4.16	4.16
	SWFWMD Demand Projections (Appendix A -Table 19)	2.70	2.86	3.02	3.11	3.19
	Excess Capacity	1.46	1.30	1.14	1.05	0.97
Total Projected Excess Capacity		23.86	16.58	8.35	2.53	-1.77
Regional 17% Capacity Standard Reserve		11.92	12.91	13.97	15.13	16.38
Total Excess Capacity		11.94	3.67	-5.62	-12.60	-18.15

Notes:

(1) DCI service area not included in demand projections until 2024 when the county proposes to interconnect that facility to their distribution system; therefore, the DCI facility capacity was not included 2020

As calculated in Table 7-5, the regional excess capacity is largely needed to maintain the regional adopted 17% Capacity Standard BMP; however, a few municipalities have availability long term that might be shared. In the current year 2020 regional excess capacity of 11.94 MGD is available, and all entities excluding DeSoto County have either Authority contracted allocations or excess water

treatment facility capacity to share with neighboring utilities in a long-term manner. By 2025, the excess available regional capacity reduces to 3.67 MGD, DeSoto County is roughly self-sufficient, and Sarasota County is in need of 0.86 MGD from the region. This deficiency of finished water could be delivered to Sarasota County simply by sharing water that is an Authority allocation to other Customers. By 2030, it is projected that no additional excess capacity beyond what is reserved for the 17% Capacity Standard BMP is available. By 2040, there is a projected net regional capacity deficiency, which indicates that water supply capacities within the region beyond what are already permitted and planned for construction before 2040 must be developed. The Peace River Facility Expansion will account for regional capacity deficiency, and the Authority should look to begin the Peace River Brackish Wellfield Project by 2030 to be prepared for additional regional supply needs around or shortly after 2040. Observations from the table above include the following:

- Charlotte County is projected to have an excess capacity of 2.88 MGD in 2020; however, the increase in demand overcomes their project Authority allocation (16.1 MGD) and self-supply (2.506 MGD) before 2030. Charlotte County has not indicated a significant need in their Burnt Store Service Area; therefore, the County long-term will need to increase their allocation from the Authority before 2030 or be supplied by Punta Gorda via the Phase IA Pipeline.
- DeSoto County is projected to be approximately at capacity between their Authority allocation and their self-supply. The Authority may look to slightly increase the county's allocation.
- Manatee County is projected to have an excess capacity ranging from 4.5 MGD to 8.7 MGD through 2040 by exceeding capacity demands through infrastructure improvements, including Lake Manatee WTP upgrades, discontinuing export of water to Sarasota by 2025, developing the already permitted Buffalo Creek wellfield and bringing the RO WTP online by 2033, and receiving 5 MGD of flow from the Authority by 2037.
- Sarasota County is projected to have excess capacity in 2020 that is subsequently reduced to a deficit of 0.86 MGD by 2025. This capacity deficit is projected to reach 5.66 MGD by 2040. The majority of these deficits could be overcome by either continuing the import of Manatee County's finished water or increasing their Authority allocation.
- North Port is projected to have an excess capacity of 2.49 MGD in 2020, which decreases to 0.99 MGD by 2030. The City will need to further develop their own finished water supplies, increase their Authority allocation, increase sharing capacity with Englewood, or a combination thereof before all excess capacity is consumed.
- Punta Gorda is projected to have a long-term excess capacity between 3.62 MGD in 2020 and 3.03 MGD in 2040. This excess capacity could be used to supplement Charlotte County's capacity deficits by 2030 and/or North Port's capacity deficits beginning after 2030.
- Englewood is projected to have a long-term excess capacity between 1.46 MGD in 2020 and 0.97 MGD in 2040. This excess capacity could be used to partly overcome Sarasota County's capacity deficits beginning in 2025 and/or Charlotte County's capacity deficits by 2030 through the existing interconnects.



7.7.1 Recommendations for Excess Capacity Sharing

The Authority and its Customers, Members, and Partners could all benefit from near- and long- term excess capacity sharing. In general, the Authority may consider the following recommendations:

- Pursue modifying the current OFWUP to allow Members, Customers, and Partners flexibility to access and share excess WUP capacities within the region.
- Utilize the IRWSP Master Transmission System Model to simulate excess capacity sharing scenarios to provide insights on feasibility and identify any needed changes in the transmission and distribution system.

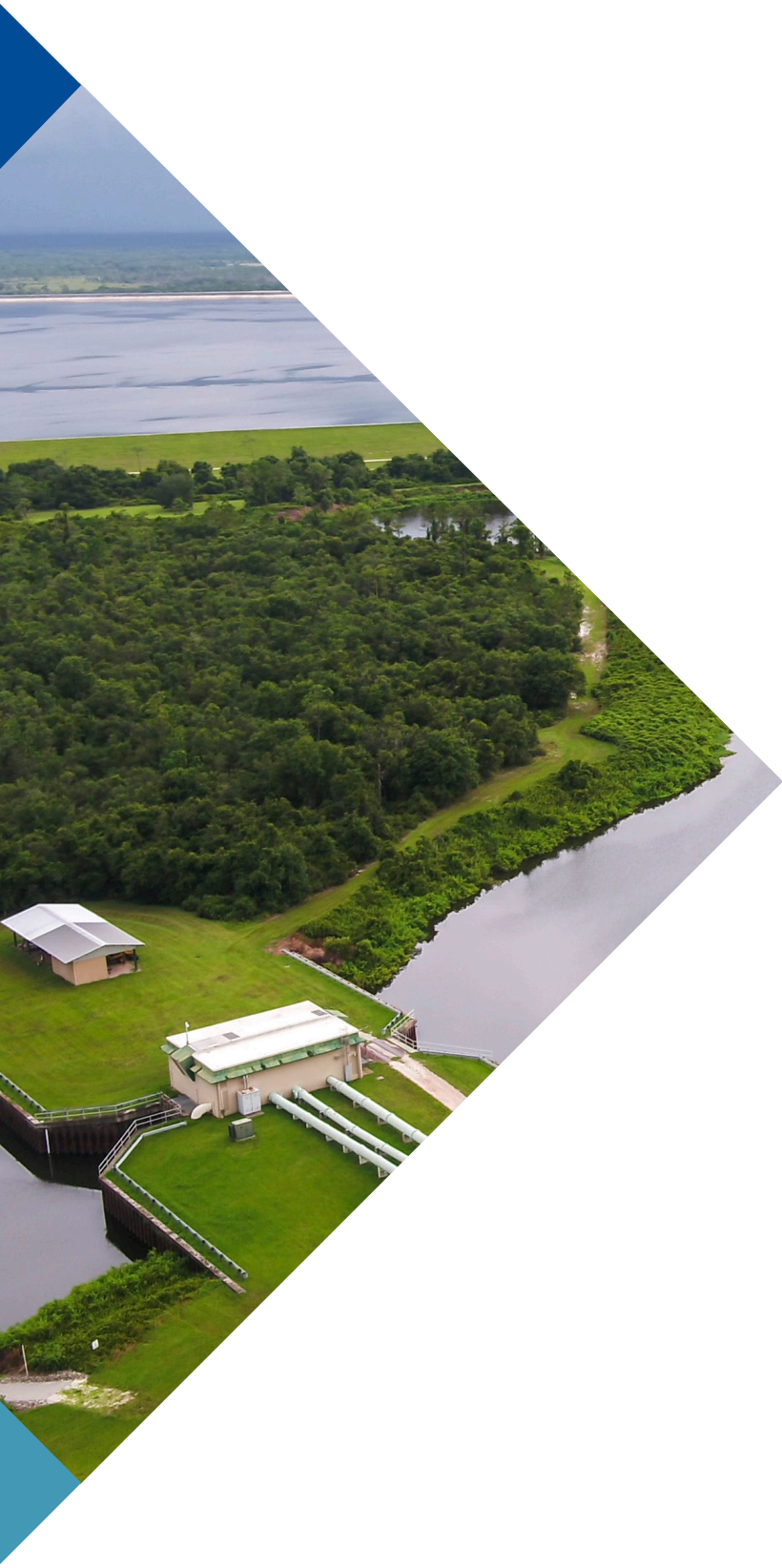
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Appendices (Included as a separate file)



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